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Assessment of the Cod Stock in NAFO Divisions 2J+3KL

by

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Abstract

Nominal catches for this stock declined from a peak of about 800,000 t in 1968 to a low of about 140,000 t in 1978. Catches for the period 1982-85 have been about 230,000 t while the catch for 1986 was about 250,000 t. This assessment indicates that the age 4+ biomass has increased from about 280,000 t in 1976 to the 1986 estimate of about 1.5 million tons. The 1980-82 year-class contributes about 80% of the 1986 age 4+ biomass. Assuming that the 256,000 t TAC for 1987 will be taken, the 1988 $F_{0.1}$ catch is estimated to be 293,000 t. The expected contribution of the 1980-82 year-classes to the projected 1988 catch is about 63% by weight.

Résumé

Les prises de ce stock ont diminué depuis un sommet d'environ 800 000 t en 1968 pour s'établir à un minimum d'environ 140 000 t en 1978. Pour la période de 1982 à 1985 les prises ont été d'environ 230 000 t alors qu'en 1986 elles s'établissaient à environ 250 000 t. Cette évaluation indique pour la biomasse des âges de 4 et plus un accroissement d'environ 280 000 t qu'elle était en 1976 jusqu'à environ 1,5 million de t qui est la valeur estimée pour 1986. Les classes d'âge de 1980 à 1982 constituent environ 80 % de la biomasse pour les âges de 4 et plus en 1986. En supposant que soit atteint le TPA de 256 000 t pour 1987, on estime à 293 000 t le $F_{0,1}$ pour 1988. La contribution attendue des classes d'âge de 1980 à 1982 aux prises projetées en 1988 s'établit à environ 63 % en poids.

Introduction

Nominal catch

Catches of cod from this stock declined from a peak of about 800,000 t in 1968 to a low of about 140,000 t in 1978. Quota regulations came into effect in 1973. Inshore and offshore historical catches are given in Table 1. While the inshore catch has declined from a 22 year high of 113,000 t in 1982 to 72,000 t in 1986 (Fig. 1), the offshore catch during 1986 was an eleven year high at 179,000 t. It can be seen in Table 2 that the decline in the inshore catch since 1982 was due mainly to declines in the catches by gillnets and line trawls. Recent nominal catches along with associated TAC's are as follows ('000't):

Year	1980	1981	1982	1983	1984	1985	1986	1987
Catch	176	171	230	232	230	232	252	
TAC	180	200	230	260	266	266	266	256

Nominal catches in 1986 by country, month, and division are given in Table 3. These were obtained from the Department of Fisheries and Oceans for Canadian based vessels and from NAFO circular letters, the NAFO Secretariat, FLASH data base, and Department of Fisheries and Oceans surveillance estimates for others. Surveillance estimates, calculated by country, are based on calculating catch rate information from logbooks on inspected vessels and applying this catch rate to the uninspected portion of the foreign fleet. As in recent years the Canadian fishery took the major portion of the 1986 catch (about 75%), but the foreign catch in NAFO Div. 3L was at a twelve year high (52,000 t). This catch was almost entirely taken by Spain and Portugal on the nose of the bank outside the Canadian 200 mile fishery zone.

Catch and average weight at age

Catch numbers, average weight, and average length at age for 1986 are given in Table 5. The 1980-81 year-classes dominated the commercial fishery in 1986. A summary of the sampling used to derive the catch at age is given in Table 4. Sampling coverage was well distributed and data were available to treat each NAFO division separately. The following relationship was applied in deriving average weight at age: log weight = 3.0879 log length - 5.2106. The discrepancy between reported catch and catch calculated from these average weights for 1986 was about 3%. The percentage catch-at-age during 1986 agrees quite well (Fig. 18) with the percentage catch-at-age projected during last year's assessment. A breakdown of the catch at age during 1986 by inshore and offshore components and by division is presented in Table 6. Historical catch and average weights at age used as inputs to sequential population analysis are given in Table 7.

Research vessel surveys

Research vessel surveys were conducted in the fall by the GADUS ATLANTICA in Div. 2J and Div. 3K since 1977 and 1978 respectively. Fall surveys for Div. 3L were

conducted by the A. T. CAMERON during 1981-82 and by the WILFRED TEMPLEMAN in 1983-86. The 1984 fall survey was conducted earlier than in other years (August-September as opposed to October-November). Biomass and abundance from these surveys are shown in Tables 8-13. Spring surveys were conducted IN Div. 3L from 1971 to 1982 by the A. T. CAMERON and in 1985-86 by the WILFRED TEMPLEMAN. Tables 14-15 give abundance and biomass for the latter period (1977-86) of this survey. The earlier time period was not presented because survey coverage was poor and thus estimates unreliable. Biomass and abundance tables presented in tables for all three divisions may also include estimates from depths greater than 500 meters. In some cases these depths were not surveyed. Mean numbers and weights per tow along with associated confidence limits for selected strata for fall and spring surveys are given in Tables 16-19. Selected strata were chosen as those common to all years in a particular survey series. Stratification charts used for these research vessel surveys are shown in Fig. 2-4. The biomass and abundance estimates for 1986 in Div. 2J and 3K are by far the highest in the series while those for Div. 3L (fall and spring) are close to the highest. Percentage biomass by division for 1981-86 fall surveys is given in Table 20. The relative distribution of cod biomass among divisions during 1986 was quite similar to the estimates for the 1981-83 period. During 1984 and 1985 the percentages of divisional biomass are higher than those of 1981-83 and 1986 in Div. 3L.

Tables 21-23 give mean bottom temperature and depth by depth zone for all three divisions from fall surveys. For Div. 2J and 3K the considerable cooling trend observed in 1984-85 appears to have stopped with bottom water temperatures warming to levels observed in the earlier parts of the time series.

Tables 24-27 give mean numbers per tow at age for surveys in all divisions. These values were estimated from coverage of all depths fished in a particular survey series. A survey abundance index for ages 6+ was obtained by averaging results from Div. 2J, 3K, and 3L autumn surveys weighted by the surveyed area in each division (Table 28, Fig. 12). There were no fall surveys in Div. 3L for 1978-80 and values for these years were estimated from the ratio (1.21) of ages 6+ autumn values to ages 7+ spring Div. 3L values in the following year for three overlapping years (1981, 84-85). The ages 7+ spring Div. 3L values for 1979-81 were adjusted by this ratio to give age 6+ autumn Div. 3L estimates for 1978-80. Table 29 gives recruitment indices using survey abundance estimates for ages 3-5 as indicators of year-class strength. The indices at each age were estimated using the same procedure used to estimate the age 6+ abundance index. The 1980-81 year-classes dominated at age 3 while the 1982 and 1981 year-classes dominated at ages 4 and 5 respectively.

Commercial catch-effort

Offshore catch and effort are available by division, month, country and gear, and a multiplicative model (Gavaris 1980) was used to account for the country/gear, seasonal and divisional differences. Data was obtained from NAFO Statistical Bulletins for the 1962-79 period and from the Department of Fisheries and Oceans for the latter period (1978-86). The analysis is done separately for both these series and a resultant catch rate index is derived by using 1978-79 as a reference in both time periods. As in previous assessments plots of residuals showed that data with greater catch and effort were less variable, therefore, estimated weights calculated according to Judge et al. (1980, p. 132) were applied in a weighted regression of the multiplicative model. To reduce the possible effects of truncation and rounding errors, data with less than 10 t catch or 10 hrs effort were excluded from the analysis. Results from the regression are given in Tables 30 and 31 with the catch rates given in Tables 32-33 and 46 and Fig. 5 and 11. Catch and effort information was

also analyzed by division. The results of these divisional regressions are given in Tables 34-39 with the resultant catch rates given in Tables 40-46 and Fig. 6-8. The catch rates by division for the latter time period (1978-86) were combined (weighted by average survey biomass) to derive an index for the stock area. This index, given in Table 47 relates (Fig. 13) quite well with the standardized 2J3KL index (r^2 = 0.83).

To examine the problem of catch rates being inflated due to fishing on spawning concentrations, the multiplicative analysis was conducted without first quarter data (Tables 48-51, Fig. 9) and first and second quarter data (Tables 53-55, Fig. 10). The relationships of these catch rate indices (normalized to their respective means) to those obtained from the analysis for the entire year for both time periods (1962-79, 1978-86) are given in Table 56 and displayed in Fig. 14-17. The resultant catch rate series were similar to those obtained in the original analysis with r^2 values for these relationsnips ranging from 0.80 to 0.98.

Table 57 gives catch, effort, and associated catch rate for first quarter Canada-Newfoundland tonnage class 5 vessels for the period 1978-87. While the 1987 first quarter 2J and 3L catch rates are down from 1986 values the 1987 first quarter Div. 3K catch rate is the highest in the time series. Catch rate values estimated by observers for the period 1983-87 for the first quarter Can-N tonnage class 5 vessels are presented in Table 58. The conclusion derived from these observer data are similar to those derived from Table 57, although the amount of observed effort from wnich catch rates are estimated is minimal in some cases.

Information on catch per purchase slip for the insnore fishery for the period 1981-86 is presented for Div. 2J, 3K, and 3L in Tables 59-61 respectively. Gear types examined include trap, gillnet, line trawl, and handline. The data was also disaggregated into vessel size categories with vessels less than 35' classified as insnore, while vessels between 35 and 64' were classified as nearshore. In general, no trends in catch per slip were observed for vessels between 35 and 64 feet in all three divisions, while the catch per slip has declined in Div. 3K and 2J and remained stable in Div. 3L for vessels less than 35 feet. The catch in Div. 3L declined as effort declined while the catch in Div. 2J and 3K declined as effort remained stable. The procedure of recording catch data on purchase slips was changed in 1986 in that a single landing could be ascribed to several purchase slips. This would result in an underestimate of the catch per slip for this year, but the degree of this bias is not quantified.

Sequential Population Analysis

Assuming a natural mortality of 0.2, conort analysis was performed over a range of fully recruited fishing mortalities in 1986. Partial recruitment values, used in the calibration of the cohort analysis were estimated as the average of the pattern in tne years 1980-84. Partial recruitment patterns (selectivity coefficients) for the period 1962-86 are presented in Table 62.

Age 7+ population numbers at the beginning of the following year as derived from conort analysis were regressed on the age 6+ survey abundance index. This relationsnip yielded the highest r^2 value with fishing mortality in 1986 between 0.25 and 0.30 and the intercept was at the origin for fishing mortalities between 0.20 and 0.25 (Table 63). A large residual for the 1986 point was not unexpected because the severe environmental conditions in this year may have caused abundance to be underestimated. This relationship at a fishing mortality in 1986 of 0.25 is displayed in Fig. 19.

Offshore exploitable biomass was regressed on standardized catch rates for the period 1962-86. Calibration of SPA with this relationship indicated the highest r^2 value with a terminal F of 0.15 in 1986 (Table 64, Fig. 20). With uncertainty in relating the two time periods for which catch rates were analyzed (1962-79, 1978-86) the relationship between catch rate and offshore exploitable biomass for the 1978-86 period was used to calibrate the cohort analysis. Due to the high 1984 and 1985 values and the somewhat lower values for 1986 in the catch rate series, this relationship yields higher r^2 values as fishing mortality in 1986 decreases (Table 65). However, the intercept was at the origin for a fully recruited fishing mortality in 1986 of 0.17 (Fig. 21).

Calibrations using research vessel survey and commercial catch rate indices implied F values in 1986 of 0.25 and 0.17 respectively. The midpoint of these values is 0.21 and results of cohort analysis at this level, including population biomass (average), beginning year population numbers and fishing mortality are presented in Table 68.

Recruitment

The relationship of the age 3 survey index with SPA age 4 values at the beginning of the following year, for the 1975-79 year-classes (Table 66, Fig. 22), predicted the size of the 1982 year-class to be 473 million fish. As the values of the 1980 and 1981 year-class indices were outside the range of the values used in the relationship, these year-classes were also set equal to the 1982 estimate of 473 million. This level of recruitment is the largest since the 1968 year-class and is about 20% higher than the 1962-83 geometric mean (365 million). Although the survey indices at ages 4 and 5 did not relate significantly with SPA, the 1980-82 year-classes in the survey age 4 index and the 1980-81 year-classes in the survey age 5 index were among the highest in their respective time series.

Partial recruitment values were adjusted to give approximate values estimated from the recruitment index for the 1980-82 year-classes. The values of these year-classes and the partial recruitment vectors used are given in Table 67.

Catch projections

The parameters used in stock and catch projections are given in Table 69. The size of the 1983 year-class was estimated to be about 300 million fish from the age 3 survey abundance index described earlier. The 1984 year-class was set at the 1977-83 geometric mean of 265 million fish. Average weight-at-age values declined from 1984 to 1986 with a decline from 1985 to 1986 occurring at older ages (7+). With the uncertainties associated with the change in weights at age in recent years the weight-at-age values used for catch projections are averages of the values for 1984-86. Assuming that the 256,000 t TAC for 1987 will be taken, the 1988 $F_{0.1}$ catch is estimated to be 293,000 t (Table 70). This represents an increase of about 15% over the 1987 TAC.

References

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Can. J. Fish. Aquat. Sci. 37: 2272-2275.

Judge, C. C., W. E. Griffiths, R. C. Hills, and T. C. Lee. 1980. The theory and practice of econometrics. John Wiley and Sons, New York. 793 p.

le 1. Historical catches of cod from NAFO Divisions 2J3KL for the period 1959-86.

	2J				3K				3L				Total	Total		
		Offshore				Offshore				Offshore						
r	Inshore	Can.	Other	Total	Inshore	Can.	Other	Total	Inshore	Can.	Other	Total	inshore	offshore	Total	TAC
9	17533	-	46372	46372	56264	-	97678	97678	85695	4515	51515	56030	159492	200080	359572	-
0	15418	1	164036	164037	47676	53	69855	69908	94192	7355	60213	67568	157286	301513	458799	-
1	17545	1	243147	243148	31159	-	60574	60574	70659	4675	70318	74993	119363	378715	498078	-
2	23424	-	226841	226841	42816	-	45554	45554	72271	4383	87463	91846	138511	364241	502752	-
3	23767	1	197868	197869	47486	-	79331	79331	73295	4446	83015	87461	144548	364661	509209	-
4	14787	13	197359	197372	40735	-	121423	121423	75806	10158	142370	152528	131328	471323	602651	-
5	25117	-	246650	246650	26467	21	50097	50118	58943	7353	130387	137740	110527	434508	545035	-
6	22645	39	226244	226283	32208	13	58907	58920	55990	8253	120206	128459	110843	413662	524505	-
7	27721	28	217255	217283	24905	114	78687	78801	49233	13478	200343	213821	101859	509905	611764	-
8	12937	4650	355108	359758	40768	1849	119778	121627	47332	15784	211808	227592	101037	708977	810014	-
9	4328	30	405231	405261	24923	56	80949	81005	67973	18255	151945	170200	97224	656466	753690	-
0	1963	-	212961	212961	21512	92	78274	78366	53113	14471	137840	152311	76588	443638	520226	-
1	3313	-	154700	154700	21111	31	61506	61537	38115	11976	148766	160742	62539	376979	439518	-
2	1725	-	149435	149435	14054	7	133369	133376	46273	4380	109052	113432	62052	396243	458295	-
3	3619	1123	52985	54108	13190	108	159653	159761	24839	1258	97734	98992	41648	312861	354509	666000
4	1804	-	119463	119463	10747	19	149189	149208	22630	880	67918	68798	35181	337469	372650	657000
5	3000	410	78578	78988	15518	189	112678	112867	22695	670	53770	54440	41213	246295	287508	554000
6	3851	94	30691	30785	20879	771	79540	80311	35209	2187	40998	43185	59939	154281	214220	300000
7	3523	525	39584	40109	28818	1051	26776	27827	40282	5362	26799	32161	72623	100097	172720	160000
8	6638	4682	17546	22228	29623	7027	6373	13400	45194	9213	12263	21476	81455	57104	138559	135000
9	8445	9194	6537	15731	27018	21579	16890	38469	50359	14184	12693	26877	85822	81077	166899	180000
0	17210	13592	7437	21029	37015	21920	6830	28750	42298	15523	13963	29486	96523	79265	175788	180000
1	14215	22125	4760	26885	23002	23112	3847	26959	42821	21760	15070	36830	80038	90674	170712	200000
2	14429	58384	8923	67307	42141	8881	4074	12955	56479	27192	9271	36463	113049	116725	229774	230000
3	10743	37281	4158	41439	40681	31623	2815	34438	54999	39125	10920	50044	106423	125922	232345	260000
4	12772	10994	1523	12517	35100	47866	10127	57993	49428	49603	12974	62577	97300	133087	230387	266000
5	10076	1472	11	1483	30337	68507	9714	78221	39309	37748	34394	72142	79722	151846	231568	266000
6	12567	4627	7373	12011	28539	58239	2226	60465	31263	55117	51555	106672	72369	179137	251506	266000

Table 2. Cod catches (000't) by division and gear in NAFO Divisions 2J, 3K, and 3L from 1975 to 1986.

Year	2J				3K			
	Trap	GN	LL	HL	Trap	GN	LL	HL
1975	0.7	2.3	0	<0.1	4.7	8.5	0.6	1.6
1976	0.4	2.4	<0.1	<0.1	7.1	10.6	0.7	2.4
1977	1.5	1.9	<0.1	0.1	11.5	11.6	1.3	4.4
1978	3.0	3.2	0.1	0.3	11.3	11.4	3.6	3.2
1979	1.3	5.7	0.2	1.3	3.5	11.5	8.4	3.6
1980	4.7	11.4	0.2	0.9	12.7	13.5	8.1	2.7
1981	3.9	10.1	0.1	0.2	4.0	10.7	6.4	2.0
1982	4.5	9.1	0.1	0.7	16.4	17.6	6.1	2.1
1983	3.9	4.9	0.8	1.2	10.5	16.3	2.6	9.3
1984	5.3	6.0	0.4	1.0	9.9	14.3	2.4	8.4
1985	4.6	2.7	0.2	1.8	13.4	8.0	2.3	6.6
1986	4.3	7.6	0.1	0.6	14.8	7.6	1.4	4.7
	3L				Total			
1975	10.4	7.5	1.6	3.1	15.8	18.3	2.2	4.7
1976	18.4	9.1	2.9	4.8	25.9	22.1	3.6	7.2
1977	21.0	8.9	3.6	6.9	34.0	22.4	4.9	11.4
1978	23.2	9.0	5.1	7.8	37.5	23.6	8.8	11.3
1979	20.8	13.5	7.0	9.1	25.6	30.7	15.6	14.0
1980	12.9	11.2	9.4	8.8	30.3	36.1	17.7	12.4
1981	10.2	13.6	11.4	7.6	18.1	34.4	17.9	9.8
1982	24.2	20.3	5.7	6.2	45.1	47.0	11.9	9.0
1983	25.7	16.4	3.8	9.0	40.1	39.6	7.2	19.5
1984	23.0	14.9	3.8	7.4	38.2	35.2	6.6	16.8
1985	21.8	8.8	2.6	5.7	39.8	19.5	5.1	14.1
1986	15.8	8.9	2.4	4.1	34.9	24.2	3.9	9.4

Table 3. Cod landings (t) from Divisions 2J, 3K, and 3L by country during 1986.

Month	Can(N) Ins.	Can(N) Off.	Can(M)	FRG	France	GDR	Poland	UK	USSR	Japan	Total
					2J						
Jan.		2,311	1,235	6,131	386						10,063
Feb.											
Mar.		145									145
Apr.			138								138
May	2	5	8								15
June	255	2	1								258
July	2,990	6								6	3,002
Aug.	7,123	100	4						6	1	7,234
Sept.	1,918	120	8						5	1	2,052
Oct.	256	297									553
Nov.	23	159						235		1	418
Dec.		35	53					542		59	689
	12,567	3,180	1,447	6,131	386			777	11	68	24,567
					3K						
Jan.	2	8,154	1,658	794	1,153						11,761
Feb.		13,396	3,994								17,390
Mar.	2	10,435	1,052								11,489
Apr.	1	3,180	3,940								7,121
May	1,441	5,410	2,479								9,330
June	2,532	370	870								3,772
July	13,385	32	355								13,772
Aug.	7,880	101	564						34		8,579
Sept.	2,530	74	2						38	20	2,664
Oct.	685	158	3				2		4		852
Nov.	78	72	42					1		10	203
Dec.	3	1,575	323			2		164	1	13	2,071
	28,539	42,957	15,282	794	1,153	2	2	165	77	43	89,004

. . . (Cont'd.)

Table 3 (Cont'd.)

Month	Can(N) Ins.	Can(N) Off.	Can(M)	GDR	USSR	Port[a]	Spain[a]	Mexico/Chile[b]
				3L				
Jan.	60	1,173	744					
Feb.	28	866						
Mar.	19	3,832	212					
Apr.	159	14,282	1,633					
May	1,827	2,009	267					
June	7,933	3,615	1,470					
July	10,538	3,178	1,724					
Aug.	5,711	1,803	154		1			
Sept.	3,334	3,144	210					
Oct.	1,346	3,330		3				
Nov.	226	5,186	1,662	4				
Dec.	82	2,567	2,056					
UK						29,903	21,109	535
	31,263	44,985	10,132	7	1	29,903	21,109	535

Total = 137,935

Total 2J3KL = 251,506 t

[a]Landings as reported to NAFO.

[b]Landings estimated from Canadian surveillance.

Table 4 . Commercial sampling for Divisions 2J+3KL cod in 1986.

Div.	Gear	Qtr.	Country	No. aged	Month	No. meas.	Landings, (t) Country/month	Landings, (t) Total
2J	OT	1-2	Can(N)	56	Jan	1,873	2,311	3,845
			France(M)	73	"	567	386	386
			FRG	286	"	9,670	6,131	6,131
				415		12,110		10,362
	OT	3-4	UK	88	Nov.	2,790	235	235
			UK		Dec.	634	542	542
			Japan	25	Dec.	258	59	59
			Other					189
				113		3,682		1,025
	GN	3-4	Port[a]	65	Aug.	373	101	168
			"	59	Sept.	761	297	297
			"		Nov.	580	159	159
				124		1,714		624
	Trap	3	Can(N)	440	Aug.	7,458	2,331	4,340
	GN	3	"		July	104	1,120	1,282
			"		Aug.	9,030	4,560	4,560
	HL	3	"		Aug.	146	620	620
				440		16,738		10,802
	GN	4	"	200	Sept.	618	1,551	1,765
				200		618		1,765
2J	Total			1,292		34,862		24,578
3K	OT	1	Can(N)		Jan.	12,857	8,154	9,812
			"	655	Feb.	13,671	13,396	17,390
			"		Mar.	7,284	10,435	11,487
			France(M)	68	Jan.	1,000	1,153	1,153
			FRG	40	Jan.	1,116	794	794
				763		35,928		40,636
		2	Can(N)	499	Apr.	2,437	3,180	7,120
			"		May	4,122	5,410	9,031
				499		6,559		16,151
		3+4	Can(N)	172	Dec.	821	1,575	1,898
			UK		Dec.	246	154	155
			Other					1,625
				172		1,067		3,678

. . . (Cont'd.)

Table 4 (Cont'd.)

Div.	Gear	Qtr.	Country	No. aged	Month	No. meas.	Landings, (t) Country/month	Landings, (t) Total
3K	Trap	3	Can(N)	1,052	June	1,792	1,112	1,312
			"		July	6,801	8,911	8,911
			"		Aug.	1,602	3,931	4,580
	GN	3	"		July	2,564	3,849	5,859
					Aug.	910	1,279	1,777
	HL	3	"		June	886	496	501
					July	1,004	566	566
			"		Aug.	2,212	2,274	2,274
	LT	3	"		June	484	144	155
			"		Aug.	2,895	396	396
			"		Other			59
	HL	4	"	379	Sept.	4,837	1,123	1,343
	LT		"		Sept.	1,971	536	806
				1,431		27,958		28,539
3K	Total			2,865		71,512		89,004
3L	OT	1	Can(N)	487	Jan.	771	1,173	1,917
					Mar.	9,784	3,832	4,044
					Other			866
				487		10,555		6,827
		2	Can(N)	495	April	9,106	14,282	15,915
					May	1,395	2,009	2,276
					June	765	3,615	5,085
				495		11,266		23,276
		3	Can(N)	363	July	2,643	3,178	4,902
					Aug.	1,172	1,803	1,958
					Sept.	1,614	3,144	3,354
				363		5,429		10,214
		4	Can(N)	471	Oct.	2,949	3,330	3,333
					Nov.	5,156	5,186	6,852
					Dec.	1,470	2,567	2,567
			Can(M)		Dec.	536	2,056	2,056
				471		10,111		14,808
	OT	1-4	Can(N)	1,816		37,361		55,125
			Other					51,547[D]
	OT	Total		1,816		37,361		106,672

. . . (Cont'd.)

Table 4 (Cont'd.)

Div.	Gear	Qtr.	Country	No. aged	Month	No. meas.	Landings, (t) Country/month	Landings, (t) Total
3L	Trap	2	Can(N)	856	May	1,779	844	966
	GN		"		May	4,457	968	1,110
				856		6,236		2,076
	Trap	3	Can(N)	1,378	June	6,485	5,895	5,895
			"		July	6,019	6,927	8,922
	GN	3	"		June	1,982	1,714	1,714
					July	3,136	3,093	3,093
					Aug.	1,859	1,788	1,788
	HL	3	Can(N)		June	2,420	175	180
			"		July	1,519	398	398
			"		Aug.	4,343	1,630	1,630
	LT	3	"		Aug.	743	510	791
				1,378		28,506		24,411
	GN	4	Can(N)	691	Sept.	2,202	909	1,227
	HL		"		"	2,506	1,255	1,903
	LT		"		"	1,702	976	976
			"		Oct.	1,094	567	670
				691		7,504		4,776
3L	Total			4,741		79,607		137,935
2J3KL	Total			8,898		185,981		251,517

[a]Charter on Canadian quota.

[b]Includes: Portugal - 29,903 t - as reported to NAFO.
Spain - 21,109 t - from Canadian surveillance estimates.
Mexico/Chile - 535 t - from Canadian surveillance estimates.

Table 5. Estimated catch, average weight, and average length at age, along with associated variances for the commercial cod fishery in NAFO Divisions 2J3KL during 1986.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
2	0.211	29.353	1	0.47	0.47
3	0.509	38.713	832	118.08	0.14
4	0.724	43.415	15218	572.71	0.04
5	1.045	48.882	44168	1041.27	0.02
6	1.535	55.436	45870	1136.32	0.02
7	1.847	58.672	26025	843.38	0.03
8	2.349	63.316	14720	614.19	0.04
9	2.945	67.955	3103	277.55	0.09
10	3.469	71.696	2001	170.47	0.09
11	3.796	73.779	1976	138.68	0.07
12	4.536	77.526	1101	111.49	0.10
13	5.337	81.862	574	58.64	0.10
14	7.116	89.222	119	23.15	0.19
15	11.773	107.178	30	5.74	0.19
16	11.244	105.926	18	4.79	0.26
17	14.149	113.716	12	3.65	0.31
18	16.142	118.686	10	2.31	0.23
19	12.296	108.703	2	1.25	0.78
20	15.723	118.811	2	1.57	0.63
21	11.049	106.000	2	1.63	1.03
22	16.628	121.000	1		
23	20.751	130.000	1		0.01

Table 6. Offsnore and inshore catch at age by NAFO Division for the commercial cod fishery in Divisions 2J3KL during 1986. (Numbers X 10^{-3}).

	Offshore			Inshore			
Age	2J	3K	3L	2J	3K	3L	TOTAL
2						1	1
3	10	1	29	3	218	570	831
4	308	77	4185	305	3695	6648	15218
5	2389	2772	17844	2196	10030	8937	44168
6	1723	9181	24505	1151	4642	4667	45869
7	3058	10779	6440	2085	1792	1871	26025
8	1245	6405	4031	1231	1069	739	14720
9	69	1380	868	288	311	188	3104
10	93	1176	354	142	127	108	2000
11	151	1123	322	208	103	69	1976
12	49	685	177	56	90	44	1101
13	53	338	100	33	39	12	575
14	4	65	12	15	15	6	117
15		12	6		8	4	30
16		10	2	4	1	1	18
17		5	3	2	1		11
18		2	2		6		10
19		1			1		2
20		-			2		2
>20		4					4
Catch weight	12011	60465	106672	12567	28539	31263	251517

Table 7. Catch numbers ($X10^{-5}$) and average weight (kg) at age from the commercial cod fishery in Divisions 2J3KL over the period 1962-86.

CATCH AT AGE

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
4	267	271	267	280	663	785	916	381	572	690	798	407	145	140	337	656	176	124	120	70	325	137	149	152	152
5	658	592	563	456	942	1009	1990	964	773	921	1166	945	352	253	279	403	391	375	288	133	187	427	318	372	442
6	600	1159	590	655	632	972	1450	1534	940	944	767	592	731	344	208	121	203	292	300	249	145	190	386	336	459
7	486	579	981	629	598	553	809	1006	788	557	560	353	604	391	168	54	77	110	180	219	254	120	125	277	260
8	284	288	498	671	307	388	379	493	269	241	296	273	353	365	160	34	31	35	48	117	169	147	72	70	147
9	207	152	202	334	240	172	224	184	100	113	118	142	186	134	109	27	15	13	12	32	119	89	89	37	31
10	186	114	118	147	88	161	76	115	36	43	64	76	104	75	46	13	11	8	5	8	19	63	42	50	20
11	108	81	84	68	47	60	54	60	19	21	30	38	58	23	15	5	5	6	2	3	3	10	25	29	20
12	98	41	61	37	23	34	34	42	11	12	17	22	29	12	6	3	2	2	2	2	2	2	5	16	11
13	80	39	48	39	18	21	19	28	5	11	14	12	11	8	3	1	1	1	1	1	1	1	1	3	6
4+	2974	3316	3412	3316	3558	4155	5951	4807	3513	3553	3830	2860	2573	1745	1331	1317	912	966	958	834	1224	1186	1212	1342	1548
5+	2707	3045	3145	3036	2895	3370	5035	4426	2941	2863	3032	2453	2428	1605	994	661	736	842	838	764	899	1049	1063	1190	1396
6+	2049	2453	2582	2580	1953	2361	3045	3462	2168	1942	1866	1508	2076	1352	715	258	345	467	550	631	712	622	745	818	954
7+	1449	1294	1992	1925	1321	1389	1595	1928	1228	998	1099	916	1345	1008	507	137	142	175	250	382	567	432	359	482	495

AVERAGE WEIGHT AT AGE

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
4	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.53	0.47	0.68	0.63	0.61	0.60	0.72	0.74	0.77	0.78	0.84	0.87	0.88	0.73	0.72
5	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.64	0.71	0.91	0.96	0.93	0.97	1.04	1.13	1.16	1.17	1.20	1.32	1.20	1.10	1.04
6	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.08	0.96	1.11	1.18	1.32	1.66	1.58	1.67	1.71	1.64	1.77	1.75	1.79	1.43	1.54
7	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.52	1.30	1.27	1.39	1.75	2.33	2.46	2.46	2.38	2.23	2.10	2.28	2.28	2.06	1.85
8	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.13	1.80	1.56	1.74	2.07	2.82	3.26	3.57	3.56	2.86	2.66	2.61	2.71	2.66	2.35
9	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.86	2.20	2.05	2.21	2.24	3.46	4.05	4.41	5.01	3.81	3.09	3.18	2.96	3.23	2.94
10	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.29	2.82	2.75	2.61	2.99	3.88	4.46	5.25	5.49	5.32	4.18	3.50	3.65	3.32	3.47
11	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.95	3.19	3.13	3.34	3.67	4.78	5.02	5.80	6.72	6.29	6.16	4.79	4.28	4.06	3.80
12	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.12	3.79	3.41	3.66	4.56	6.13	6.72	7.03	7.87	7.06	7.19	7.76	6.19	4.55	4.54
13	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	5.00	4.53	4.92	4.78	6.18	7.31	8.10	8.96	8.38	7.32	8.00	9.07	8.39	7.03	5.34

Table 8. Cod abundance estimates (No. x 10^3) from research vessel surveys in NAFO Division 2J (Fall).

Depth Range (mtrs)	Stratum Number	Stratum area (mi^2)	Gadus 3 1977	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58 1981	Gadus 71 1982	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-115 1985	Gadus 131-132 1986
101-200	201	1427	13336	3071	1500	5749	8355	16692	16246	10533	15246	21638
	205	1823	2894	8039	1574	787	4550	21765	13547	25230	8159	9481
	206	2582	6889	1634	1236	2104	6220	5868	8694	30077	12764	29985
	207	2246	9745	5100	2664	3406	5479	9094	13024	14210	27849	6310
Total		8078	32864	17844	6974	12046	24604	53419	51511	80050	64018	67414
201-300	202	440	2097	462	396	5681	2378	2378	1833	1866	760	7663
	209	1608	10174	3531	21485	3410	10099	7681	29567	3862	8599	28567
	210	774	6166	4154	2760	2982	445	4713	59785	4953	299	21187
	213	1725	6944	19617	18516	19811	2158	5807	12806	6915	14028	23624
	214	1171	16716	10658	6527	10958	3956	5900	4659	25667	19030	43496
	215	1270	19281	34205	9986	25692	35768	27583	7233	8040	7424	85617
	228	1428	2948	-	6780	8254	10701	2187	2269	1853	352	12702
	234	508	1258	553	267	1506	534	2250	4698	3005	2339	5415
Total		8924	65584	73180	66717	78294	66039	58499	122850	56161	52831	228271
301-400	203	480	883	-	-	3081	81	1117	462	703	156	1784
	208	448	1017	247	1480	202	303	1368	1749	224	1043	2051
	211	330	632	5450	2737	4659	1746	2415	1325	297	776	1090
	216	384	0	-	202	3603	86	14	10	331	115	94
	222	441	50	1479	149	1258	132	0	11	11	182	17
	229	567	415	234	2873	1319	447	298	670	71	936	539
Total		2650	2997	7410	7441	14122	2795	5212	4227	1637	3208	5575
401-500	204	354	199	-	-	-	1342	142	540	1422	0	518
	217	268	0	-	-	-	0	0	0	-	0	0
	223	180	0	-	-	-	0	0	0	0	0	0
	227	686	51	-	-	-	0	21	26	0	0	51
	235	420	32	-	-	-	158	126	1135	63	32	0
Total		1908	282	-	-	-	1500	289	1701	1485	32	569
101-200		8078	32864	17844	6974	12046	24604	53419	51511	80050	64018	67414
201-300		8924	65584	73180	66717	78294	66039	58499	122850	56161	52831	228271
301-400		2650	2997	7410	7441	14122	2795	5212	4227	1637	3208	5575
401-500		1908	282	-	-	-	1500	289	1701	1485	32	569
Total			101786	98432	81130	104461	94988	117469	180290	139366	120103	302092
Upper limit			149969	131104	128646	139630	162744	151085	744785	184179	154186	468810
Lower limit			53602	65761	33613	69392	27234	83853	-384206	94552	86020	135374

Table 9. Cod biomass estimates (t) from research vessel surveys in NAFO Division 2J (Fall).

Depth Range (mtrs)	Stratum Number	Stratum area (mi^2)	Gadus 3 1977	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58 1981	Gadus 71 1982	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-118 1985	Gadus 131-132 1986
101-200	201	1427	12377	4847	3256	11319	15998	18085	16764	12033	14952	24712
	205	1823	2761	16200	2669	1676	10126	39216	11742	25093	7526	11016
	206	2582	5328	2074	2671	3849	13153	8533	11442	39133	13186	34327
	207	2246	16809	8209	4192	7738	12284	12612	12608	18136	27954	7864
Total		8078	37275	31330	12788	24582	51561	78446	58556	94395	63618	77919
201-300	202	440	3074	525	749	12964	6292	5681	3798	2948	850	10363
	209	1608	15336	5384	43569	12810	22275	18351	53925	7678	12245	37475
	210	774	10481	5572	5771	5810	823	10428	97578	9448	782	25147
	213	1725	6525	31627	31100	34068	5622	8073	14748	9401	16121	27904
	214	1171	24370	20791	13231	25095	9669	10993	6944	33853	24715	61918
	215	1270	31757	55780	19546	64301	96161	60996	12584	10471	10732	131984
	228	1428	3930	-	12374	16972	23904	4357	2215	3012	299	15820
	234	508	2857	1030	553	3699	1192	4614	5370	3657	2402	7178
Total		8924	98330	120709	126893	175719	165938	123493	197162	80468	68146	317789
301-400	203	480	1930	-	-	7467	230	3141	1369	2054	192	2982
	208	448	1962	438	3341	631	908	3750	3153	454	1454	2589
	211	330	1738	10285	5685	9384	4747	6490	3016	954	1400	1462
	216	384	0	-	484	10204	454	86	24	908	180	142
	222	441	43	2029	653	2780	281	0	105	22	281	15
	229	567	1009	319	7394	3150	1144	467	516	106	1397	816
Total		2650	6682	13071	17557	33616	7764	13934	8183	4498	4904	8006
401-500	204	354	308	-	-	-	3149	316	1506	2192	0	829
	217	268	0	-	-	-	0	0	0	-	0	0
	223	180	0	-	-	-	0	0	0	0	0	0
	227	686	131	-	-	-	0	36	129	0	0	101
	235	420	75	-	-	-	347	315	1584	121	24	0
Total		1908	514	-	-	-	3496	667	3219	2312	24	930
101-200		8078	37275	31330	12788	24582	51561	78446	58556	94395	63618	77919
201-300		8924	98330	120709	126893	175719	165938	123493	197162	80468	68146	317789
301-400		2650	6682	13071	17557	33616	7764	13934	8183	4498	4904	8006
401-500		1908	514	-	-	-	3496	667	3219	2312	24	930
Total			142961	165109	157237	233916	228894	216679	267120	181731	136723	405184
Upper 1lmit			199808	222301	253553	314419	424737	288880	1175017	241662	174398	667126
Lower 1lmit			86113	107917	60921	153412	33051	144478	-640777	121800	99048	143243

Table 10. Cod abundance estimates (No. x 10^{-3}) from research vessel surveys in NAFO Division 3K. (Fall).

Depth Range (mtrs)	Stratum Number	Stratum area (mi^2)	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58,59 1981	Gadus 71,72 1982	Gadus 86-88 1983	Gadus 101-103 1984	Gadus 116-118 1985	Gadus 132-133 1986
101-200	618	1455	-	-	-	-	-	-	4806	6458	12975
	619	1588	-	-	-	-	-	-	1243	221	930
		3043							6049	6679	13905
201-300	620	2709	17720	26203	15206	12689	4248	17610	22825	1728	31158
	621	2859	14563	25646	2759	7455	6471	4605	6070	1531	4654
	624	668	13121	23166	627	3686	2470	1128	965	552	602
	632	447	727	2265	5078	5171	2494	8321	-	1029	1158
	634	1618	4105	18157	13651	19455	11384	14186	6229	7112	99786
	635	1274	3825	1492	3706	4745	3175	1227	3275	874	3727
	636	1455	1820	2446	6051	3695	7001	2603	5413	928	3440
	637	1132	2528	5778	3909	4744	6409	8718	19062	3824	11939
Total		12162	58409	105153	50967	59636	43652	58396	61839	17578	156464
301-400	623	1027	6167	2981	7593	876	1557	5769	11764	1015	1060
	625	850	1340	2488	1515	1021	2169	1276	574	1723	808
	626	919	3191	759	1012	2235	911	1276	770	826	10451
	628	1085	1455	2891	1008	1571	570	1955	1140	1826	672
	629	495	718	446	144	50	412	562	459	272	1348
	630	544	-	588	315	225	-	306	414	82	65
	633	2179	4283	3044	2944	5106	3552	5748	5954	10059	26717
	638	2059	2720	8081	3246	9158	5699	13643	3323	9189	9080
	639	1463	1603	3075	741	1303	2921	4095	1304	2128	3423
Total		10621	21455	24155	18518	19345	17791	32630	25702	27120	53624
401-500	622	632	-	-	-	356	190	142	308	59	332
	627	1194	-	-	-	104	152	193	178	89	1262
	631	1202	-	-	-	162	0	523	18	105	68
	640	198	-	-	-	0	0		7	10	7
	645	204	-	-	-	0	5	8	15	15	-
Total		3430	-	-	-	622	347	866	526	276	1669
101-200		3043							6049	6679	13905
201-300		12162	58409	105153	50967	59636	43652	58396	61839	17578	156464
301-400		10621	21455	24153	18518	19345	17791	32630	25702	27120	53624
401-500		3430				622	347	866	526	276	1669
Total			79865	129306	69484	79602	61791	91907	94118	51653	225663
Upper 11mlt			113511	218235	93524	104928	75262	119955	125225	65201	498501
Lower 11mlt			46420	40380	45645	54276	48320	63859	63010	38104	-46976

Table 11. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3K (Fall).

Depth Range (mtrs)	Stratum Number	Stratum area (mi^2)	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58,59 1981	Gadus 71,72 1982	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-118 1985	Gadus 132-133 1986
101-200	618	1455	-	-	-	-	-	-	9363	10318	18917
	619	1588	-	-	-	-	-	-	3004	652	811
Total		3043							12367	10970	19728
201-300	620	2709	32708	55286	33699	33603	9851	33248	41781	4190	46251
	621	2859	25889	63106	5939	10935	11764	6750	14149	2229	7283
	624	668	29936	40531	1742	7973	5365	1586	959	953	1153
	632	447	873	3896	10165	7566	5721	13992		1667	2072
	634	1618	6907	29309	29404	40573	23579	22967	11703	11161	163994
	635	1274	3702	2551	7902	10271	7249	3236	5457	1619	7900
	636	1455	2248	5040	11959	8428	14144	6335	7065	1884	4489
	637	1132	3540	10613	7871	9829	13256	17317	34548	6209	17860
Total		12162	105803	210332	108681	129178	90929	105431	115662	29912	251002
301-400	623	1027	11293	7522	15746	2175	4849	12071	20190	2303	2182
	625	850	1825	5538	4626	2640	4817	3499	1397	2935	1446
	626	919	6976	1940	3242	4781	2076	3932	1653	1735	12331
	628	1085	2729	6206	2739	3848	1480	3841	2112	3000	1038
	629	495	1136	1062	337	150	1255	1167	832	346	2066
	630	544	-	1019	1174	939	-	847	708	230	84
	633	2179	6947	6379	8073	8406	8482	6558	10861	16779	45140
	638	2059	4210	13362	7161	17706	10143	23310	5511	13854	13234
	639	1463	2204	5734	1949	3225	8335	9295	2684	3349	5372
Total		10621	37320	48762	45047	43870	41437	64520	45948	44351	82893
401-500	622	632	-	-	-	1297	561	289	646	79	451
	627	1194	-	-	-	267	330	601	318	127	2121
	631	1202	-	-	-	451	0	1489	72	220	113
	640	198	-	-	-	0	0		119	59	11
	645	204	-	-	-	0	54	42	176	130	-
Total		3430	-	-	-	2015	945	2419	1331	615	2696
101-200		3430							12367	10970	19728
201-300		12162	105803	210332	108681	129178	90929	105431	115662	29912	251002
301-400		10621	37320	48762	45047	43870	41437	64520	45948	44351	82893
401-500		3430				2015	945	2419	1331	615	2696
Total			143123	259093	153728	175023	133310	172458	175307	86029	356316
Upper limit			215048	421005	201839	237798	159091	216590	228070	107721	797048
Lower limit			71198	97181	105619	112247	107529	128325	122544	64339	-84415

Table 12. Cod abundance (No. x 10^{-3}) from stratified random cruises in Division 3L (Fall).

Depth Range	Stratum No.	Stratum Area	ATC 323-325 1981	ATC 333-334 1982	W. T. 7-9 1983	W. T. 16-18 1984	W. T. 37-39 1985	A. Needler 72 1986
31-50	350	2071	4923	2332	6335	15455	13698	15197
	363	1780	802	1960	13050	19374	40659	2439
	371	1121	105	1010	4679	8018	1058	151
	372	2460	14256	8679	37532	27415	21453	6039
	384	1120	-	273	6025	20303	452	52
Total		8552	20086	14254	67621	90565	77320	23878
51-100	328	1519	-	-	-	285	385	4598
	341	1574	1930	975	1359	1512	945	1287
	342	585	381	1039	274	439	205	219
	343	525	897	-	328	2089	263	617
	348	2120	1724	3310	1953	7002	1284	1999
	349	2114	2154	1492	1622	8059	3047	2739
	364	2817	963	1113	1629	8162	1774	964
	365	1041	8693	2090	578	8400	684	1583
	370	1320	173	413	727	7799	561	248
	385	2356	44	309	318	1827	118	702
	390	1481	37	111	111	2483	48	241
Total		17452	16996	10852	8899	48057	9364	15197
101-150	344	1494	2075	5047	1103	3701	2978	2464
	347	983	2706	2915	2041	2976	719	1290
	366	1394	5197	8022	4473	6221	18207	23099
	369	961	2669	1371	2525	2803	1960	21671
	386	983	861	553	-	1513	1269	5737
	389	821	-	1756	-	811	961	985
	391	282	-	95	635	32	635	95
	Total	6918	13508	19759	10777	18057	26729	55341
151-200	345	1432	2015	3637	2929	2300	4658	5105
	346	865	5822	2337	4389	1731	3441	5089
	368	334	1316	1429	-	602	2871	6166
	387	718	808	3000	-	3072	1253	10618
	388	361	-	253	-	528	461	-
	392	145	-	147	33	103	60	16
	Total	3855	9961	10803	7351	8336	12744	26996
31-50		8552	20086	14254	67621	90565	77320	23878
51-100		17452	16996	10852	8899	48057	9364	15197
101-150		6918	13508	19759	10777	18057	26729	55341
151-200		3855	9961	10803	7351	8336	12744	26996
Total			60550	55688	94649	165427	125937	121410
Upper limit			83240	67092	123077	197373	175516	169896
Lower limit			37860	44285	66220	133481	76355	72925

Table 13. Cod biomass (t) from stratified random cruises in Division 3L (Fall).

Depth Range	Stratum No.	Stratum Area	ATC 323-325 1981	ATC 333-334 1982	W. T. 7-9 1983	W. T. 16-18 1984	W. T. 37-39 1985	A. Needler 72 1986
31-50	350	2071	6244	3849	8463	16498	11218	21047
	363	1780	852	2009	17993	20017	40414	4605
	371	1121	137	1363	6126	11210	1304	89
	372	2460	20737	6882	44364	27045	29915	11255
	384	1120	-	1090	5941	27463	583	53
	Total	8552	27970	15193	82887	102233	83434	37049
51-100	328	1519	-	-	-	299	656	3128
	341	1574	2146	901	1949	1760	957	1793
	342	585	834	951	263	736	205	233
	343	525	1419	-	661	2261	99	690
	348	2120	2651	4249	3125	11537	1995	2384
	349	2114	3604	3174	2266	8257	3856	3211
	364	2817	1932	1800	1946	4536	1419	1298
	365	1041	17904	3702	961	3624	977	1512
	370	1320	300	446	1184	7891	597	69
	385	2356	38	43	1019	1886	94	1095
	390	1481	9	58	852	1130	9	35
Total		17452	30837	15324	14226	43917	10864	15448
101-150	344	1494	3869	7701	1682	6121	4010	3623
	347	983	4550	4805	3167	5731	1245	1833
	366	1394	9313	11920	8999	7101	27549	34160
	369	961	7755	2290	5849	3962	4557	33585
	386	983	1414	1430	-	2546	4162	13630
	389	821	-	3428	-	2737	2521	1723
	391	282	-	487	159	79	325	370
Total		6918	26901	32061	19856	28277	44369	88924
151-200	345	1432	4703	7686	6443	3673	8104	9106
	346	865	12012	4212	7746	3003	5805	7670
	368	334	5948	3604	-	1222	6011	12300
	387	718	1334	9216	-	7465	4056	20225
	388	361	-	461	-	616	1951	-
	392	145	-	220	109	68	106	11
Total		3855	23997	25399	14298	16047	26033	49312
31-50		8552	27970	15193	82887	102233	83434	37049
51-100		17452	30837	15324	14226	43917	10864	15448
101-150		6918	26901	32061	19856	28277	44369	88924
151-200		3855	23997	25399	14298	16047	26033	49312
Total			109706	87997	131267	191701	164448	190731
Upper limit			153131	105967	175407	226108	212703	264591
Lower limit			66281	70027	87127	157294	116193	116872

Table 14. Cod abundance estimates (No. x 10^{-3}) from research vessel surveys in NAFO Division 3L (Spring).

Depth range (fath)	Stratum number	Stratum area (mi^2)	ATC 262 1977	ATC 276 1978	ATC 290 1979	ATC 304-5 1980	ATC 317-8 1981	ATC 329 1982	W.T. 28-30 1985	WT 48 1986
31-50	350	2,071	2,993	1,373	7,756	2,798	829	1,221	15,883	5,893
	363	1,780	4,783	2,352	7,616	1,817	3,296	1,924	7,182	7 429
	371	1,121	112	477	1,599	2,917	0	189	8,061	926
	372	2,460	2,247	8,969	6,135	3,293	5,032	1,477	27,099	12,451
	384	1,120	42	56	2,711	1,555	42	42	98	1,906
Total		8,552	10,177	13,227	25,817	12,380	9,199	4,853	58,323	28,605
51-100	328	1,519	72	-	296	-	0	342	257	443
	341	1,574	3,161	325	827	1,024	1,004	2,150	3,505	1,661
	342	585	768	747	132	417	-	278	586	454
	343	525	335	867	768	1,399	867	2,374	1,103	719
	348	2,120	875	2,361	3,687	3,456	887	2,467	4,986	5,450
	349	2,114	3,385	4,337	4,035	2,997	595	3,729	7,016	6,767
	364	2,817	967	599	4,705	2,996	952	1,304	5,821	3,483
	365	1,041	781	391	2,481	1,035	-	4,689	1,797	1,516
	370	1,320	66	330	817	1,486	0	248	7,394	805
	385	2,356	383	59	783	3,139	59	0	2,087	258
	390	1,481	1,223	1,056	2,223	1,223	389	139	358	97
Total		17,452	12,016	11,072	20,754	19,172	4,753	17,720	34,910	21,653
101-150	344	1,494	7,327	11,635	15,981	7,947	29,001	9,196	695	4,864
	347	983	861	6,254	5,737	10,212	3,247	10,773	1,668	5,519
	366	1,394	10,461	-	11,118	5,232	56,749	18,521	41,420	20,339
	369	961	761	577	2,813	6,757	7,286	1,876	10,950	9,534
	386	983	1,599	639	2,749	2,066	2,693	812	5,371	1,783
	389	821	2,178	1,130	1,464	5,259	1,140	2,712	8,677	1,380
	391	282	921	201	1,117	1,757	688	191	476	603
Total		6,918	24,108	20,436	40,979	39,230	100,804	44,081	69,257	44,022
151-200	345	1,432	5,505	5,321	1,800	6,385	15,264	2,714	2,107	13,160
	346	865	782	-	1,380	1,125	2,727	801	714	16,999
	368	334	319	-	56	113	1,880	639	1,492	4,250
	387	718	108	198	256	108	296	1,419	24,226	5,686
	388	361	881	297	190	41	393	389	468	2,520
	392	145	44	44	178	5	196	218	1,818	,403
Total		3,855	7,639	5,820	3,860	7,777	20,756	6,780	30,845	43,018
31-50		8,551	10,177	13,227	25,817	12,380	9,199	4,853	58,323	28,605
51-100		17,452	12,016	11,072	20,754	19,172	4,753	17,720	34,910	21,653
101-200		6,918	24,108	20,436	40,979	39,230	100,804	44,081	69,257	44,022
151-200		3,855	7,639	5,820	3,860	7,777	20,756	6,780	30,845	43,018
Total			53,938	50,554	91,410	78,560	135,716	73,433	193,335	137,299
Upper Limit			67,857	70,457	112,937	93,294	266,824	94,202	255,581	161,282
Lower Limit			40,018	30,651	69,883	63,827	4,608	52,665	131,090	113,317

Table 15. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3L (Spring).

Depth range (fath)	Stratum number	Stratum area (mi^2)	ATC 262 1977	ATC 276 1978	ATC 290 1979	ATC 304-5 1980	ATC 317-8 1981	ATC 329 1982	WT 28-30 1985	WT 48 1986
31-50	350	2,071	5,187	2,106	13,637	7,124	2,539	4,775	31,785	16,344
	363	1,780	5,399	3,919	11,237	4,182	7,082	6,721	14,881	12,152
	371	1,121	535	1,490	2,439	8,148	0	789	15,647	3,184
	372	2,460	1,865	7,006	8,342	7,448	7,155	3,978	44,792	19,171
	384	1,120	10	19	3,521	2,480	462	231	284	3,667
Total		8,552	12,996	14,540	39,176	29,382	17,238	16,494	107,389	54,518
51-100	328	1,519	38	-	518	-	0	893	74	838
	341	1,574	3,916	1,006	2,468	3,291	2,038	8,495	4,735	8,022
	342	585	1,196	3,010	409	961	-	871	429	1,639
	343	525	438	1,789	1,190	2,936	946	4,768	795	1,502
	348	2,120	1,701	3,546	7,128	7,855	1,966	5,709	7,904	11,590
	349	2,114	10,746	8,879	8,800	7,282	1,321	10,182	16,005	27,730
	364	2,817	1,101	928	7,884	7,154	1,533	3,938	9,837	9,223
	365	1,041	1,112	532	2,953	2,442	-	6,056	2,160	3,324
	370	1,320	330	367	1,046	2,807	0	99	7,054	3,511
	385	2,356	422	80	1,118	6,278	413	0	2,084	424
	390	1,481	505	795	2,125	2,798	500	217	261	406
Total		17,452	21,505	20,932	35,639	43,804	8,717	41,228	51,338	68,214
101-150	344	1,494	7,784	20,366	19,398	10,172	50,712	19,583	648	8,032
	347	983	1,128	8,492	7,705	16,019	8,043	21,435	3,416	10,419
	366	1,394	6,211	-	11,509	5,912	81,497	21,817	45,178	30,705
	369	961	2,050	999	2,448	7,406	9,378	4,959	19,297	11,488
	386	983	1,228	251	2,881	2,361	4,593	1,279	3,877	1,906
	389	921	1,343	1,063	1,098	6,923	478	1,664	6,169	900
	391	282	634	356	1,048	2,064	1,212	95	429	825
Total		6,918	20,378	31,527	46,087	50,857	155,913	70,832	79,014	64,276
151-200	345	1,432	13,271	10,687	4,844	11,674	29,493	6,060	2,939	17,444
	346	865	990	-	2,137	2,154	4,307	1,223	341	20,427
	368	334	404	-	239	796	1,761	809	1,536	6,412
	387	718	122	184	459	256	243	2,353	21,491	6,555
	388	361	1,181	181	349	108	190	1,321	346	1,572
	392	145	30	66	189	0	128	256	2,237	435
Total		3,855	15,998	11,118	8,217	14,988	36,122	12,022	28,890	52,845
31-50		8,552	12,996	14,540	39,176	29,382	17,238	16,494	107,389	54,518
51-100		17,452	21,505	20,932	35,639	43,804	8,717	41,228	51,338	68,214
101-150		6,918	20,378	31,527	46,087	50,857	155,913	70,832	79,014	64,276
151-200		3,855	15,998	11,118	8,217	14,988	36,122	12,022	28,890	52,845
Total			70,877	78,118	129,117	139,030	218,214	140,578	266,628	239,857
Upper limit			93,640	100,261	154,966	166,965	405,205	171,826	337,779	278,797
Lower limit			48,114	55,974	103,267	111,094	31,224	109,329	195,476	200,916

Table 16. Mean numbers and weights per tow of cod from research vessel surveys in Division 2J for strata surveyed in all years (fall surveys).

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Numbers										
Mean	74.91	75.68	56.90	68.70	63.36	87.34	134.94	103.57	91.05	220.00
Upper	112.36	104.08	94.09	95.06	118.77	113.11	567.98	137.91	117.81	347.47
Lower	37.45	47.28	19.71	42.34	7.96	61.57	-298.09	69.22	65.50	92.52
Weights										
Mean	104.60	126.70	110.80	152.92	154.00	159.84	199.75	133.06	104.36	295.27
Upper	153.79	175.60	185.66	212.54	302.83	215.17	896.24	178.95	133.27	495.49
Lower	55.41	77.81	35.94	93.30	5.17	104.51	-496.75	87.16	75.45	95.05

Table 17. Mean numbers and weights per tow of cod from research vessel surveys in Division 3K for strata surveyed in all years (fall surveys).

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986
Numbers									
Mean	48.54	77.41	39.17	46.20	36.03	50.36	53.26	26.64	127.66
Upper	71.77	132.49	52.66	61.60	44.23	65.59	71.94	34.01	293.22
Lower	25.31	22.34	25.69	30.79	27.84	35.14	34.58	19.27	-37.90
Weights									
Mean	86.95	155.36	87.03	100.57	77.41	94.81	98.34	44.34	202.76
Upper	131.76	257.53	113.99	138.67	93.15	116.93	129.84	56.49	470.92
Lower	42.14	53.20	60.07	64.47	61.66	72.68	66.85	32.19	-65.40

Table 18. Mean numbers and weights per tow of cod from research vessel fall surveys in Division 3L for strata common to all years and less than 366 meters.

Year	1981	1982	1983	1984	1985	1986
Numbers						
Mean	25.19	21.41	38.94	60.31	52.23	41.13
Upper	35.26	26.36	51.37	72.40	74.21	62.15
Lower	15.12	16.46	26.51	48.23	30.25	20.11
Weights						
Mean	44.27	30.25	55.30	64.78	64.11	61.61
Upper	63.92	37.47	74.90	75.72	85.34	94.34
Lower	24.62	23.02	35.70	53.83	42.88	28.89

Table 19. Mean numbers and weights per tow of cod from research vessel spring surveys in Division 3L for strata less than 366 meters.

Year	1977	1978	1979	1980	1981	1982	1985	1986
Numbers								
Mean	19.54	20.62	33.11	29.68	51.04	26.60	69.70	49.73
Upper	24.58	28.73	40.91	35.25	100.35	34.12	92.14	58.42
Lower	14.50	12.50	25.31	24.12	1.73	19.08	47.26	41.05
Weights								
Mean	25.67	31.86	46.77	52.33	82.07	50.92	96.12	86.68
Upper	33.92	40.89	56.13	63.09	152.39	62.24	121.78	100.99
Lower	17.43	22.83	37.41	41.98	11.74	39.60	70.47	72.78

Table 20. Biomass estimates (000't) of cod from autumn research vessel surveys in NAFO Div. 2J, 3K and 3L.

Div.	1981	1982	1983	1984	1985	1986	
2J	228.8	216.5	267.1	181.7	136.7	405.2	
3K	175.0	133.3	172.5	175.3	86.0	356.3	
3L	109.7	88.0	131.3	191.7	164.4	190.7	
Total	513.5	437.8	570.9	548.7	387.1	952.2	
Percentage							Average
2J	45	49	47	33	35	43	42
3K	34	31	30	32	23	37	31
3L	21	20	23	35	42	20	27
Total	100	100	100	100	100	100	100

Table 21 . Number of sets, mean bottom temperatures and mean depths by depth zone from fall research vessel surveys in NAFO Division 2J.

Depth range (m)	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
No. of sets										
101-200	22	18	17	19	33	51	38	29	41	30
201-300	43	23	27	22	35	59	46	34	46	40
301-400	18	12	11	13	12	17	17	15	16	13
401-500	15	-	-	-	10	16	13	10	12	11
Mean temperature										
101-200	2.53	0.78	1.27	0.59	1.04	0.13	-0.48	-0.70	-0.32	1.23
201-300	2.87	1.87	2.42	2.04	2.14	1.25	1.14	0.27	0.33	2.42
301-400	3.51	3.15	3.38	2.58	3.09	2.36	2.88	2.13	1.83	3.05
401-500	3.75	-	-	-	2.92	3.27	3.68	3.38	3.32	3.42
Mean depth										
101-200	175	175	173	168	165	166	167	173	170	160
201-300	241	265	253	269	236	255	255	252	239	241
301-400	346	347	341	339	343	339	339	349	342	343
401-500	452	-	-	-	433	419	463	456	450	439

Table 22. Number of sets, mean bottom temperatures and mean depths by depth zone from fall research vessel surveys in NAFO Division 3K.

Depth range (m)	1978	1979	1980	1981	1982	1983	1984	1985	1986
No. of sets									
101-200	-	-	-	-	-	-	11	13	10
201-300	37	39	41	49	63	51	62	67	46
301-400	33	30	37	46	52	54	58	61	38
401-500	-	-	-	17	17	15	21	24	13
Mean temperature									
101-200	-	-	-	-	-	-	-1.14	-1.11	0.55
201-300	2.61	1.91	1.73	1.64	1.26	0.98	0.79	0.64	2.06
301-400	3.51	3.06	1.70	2.96	2.84	2.82	2.46	2.03	2.75
401-500	-	-	-	3.30	3.13	3.34	3.20	2.65	3.01
Mean depth									
101-200	-	-	-	-	-	-	178	170	157
201-300	256	258	258	251	255	256	254	257	250
301-400	328	340	332	332	329	330	340	340	341
401-500	-	-	-	454	444	447	452	452	453

Table 23 . Number of sets, mean bottom temperatures, and mean depth by depth zone from fall research vessel surveys in NAFO Div. 3L.

Depth range (fath)	1981	1982	1983	1984	1985	1986
No. of sets						
31-50	22	21	23	46	51	35
51-100	51	51	80	76	111	59
101-150	15	27	39	46	53	28
151-200	11	20	24	22	30	13
Mean temperature						
31-50	0.18	1.24	-0.17	-0.67	-0.12	0.40
51-100	-0.43	-0.67	-1.16	-0.96	-1.14	-0.61
101-150	0.63	0.46	-0.31	-0.22	0.15	0.89
151-200	2.66	2.39	2.18	2.26	1.66	2.53
Mean depth						
31-50	77	76	79	76	76	77
51-100	133	142	147	139	136	139
101-150	214	233	221	225	220	231
151-200	317	322	315	319	311	318

Table 24. Mean number per tow of cod at age from research vessel surveys in Division 2J for strata surveyed in all years (fall surveys).

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	0.0	0.0	0.0	0.38	0.0	1.28	2.41	0.63	0.07	0.04
2	3.98	0.60	0.35	1.64	4.50	3.72	17.08	6.38	1.86	2.69
3	11.50	8.86	1.54	1.40	3.31	21.96	20.39	20.15	11.19	10.01
4	34.69	16.35	12.93	4.77	2.48	7.73	31.40	19.91	27.25	36.85
5	15.87	33.06	18.96	21.67	4.57	5.38	19.94	32.12	16.85	82.93
6	3.49	11.32	18.26	22.13	18.41	5.15	10.72	12.26	20.43	48.70
7	1.62	2.51	2.60	13.13	16.48	15.94	5.50	2.96	9.04	25.49
8	1.46	0.91	0.82	1.90	10.42	14.02	14.95	1.87	1.56	10.27
9	1.14	0.72	0.56	0.55	2.16	9.52	6.80	4.21	1.06	.85
10	0.63	0.52	0.32	0.40	0.55	1.60	4.31	1.81	1.46	.78
11	0.24	0.28	0.32	0.26	0.09	0.43	0.90	0.79	0.53	.71
12	0.12	0.13	0.12	0.31	0.15	0.20	0.29	0.38	0.27	.41
13	0.05	0.16	0.05	0.10	0.16	0.12	0.13	0.06	0.04	.13
14+	0.07	0.25	0.09	0.33	0.23	0.27	0.16	0.03	0.03	.13
Total	74.91	75.68	56.90	68.70	63.36	87.34	134.94	103.57	91.65	220.00

Table 25 . Mean number per tow of cod at age from research vessel surveys in Division 3K for strata surveyed in all years (fall surveys).

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	0.0	0.0	0.21	0.01	0.27	0.97	0.31	0.01	.43
2	0.31	0.16	1.20	1.55	2.13	3.93	3.92	0.73	3.00
3	3.27	2.68	1.63	6.38	2.06	8.53	6.77	3.35	6.01
4	14.27	18.23	2.35	4.00	5.86	7.22	11.70	5.16	29.94
5	17.40	30.00	13.24	4.36	5.78	12.72	9.43	7.03	36.12
6	7.98	17.84	14.47	14.56	3.24	3.89	9.68	3.50	25.07
7	2.55	4.58	3.13	10.53	6.83	2.63	3.59	3.37	12.83
8	1.19	2.30	1.51	3.27	6.66	4.63	1.80	1.04	7.73
9	0.74	0.56	0.56	0.60	1.94	3.59	2.88	0.78	2.95
10	0.58	0.48	0.38	0.28	0.75	1.25	1.74	0.72	.98
11	0.04	0.33	0.03	0.23	0.20	0.44	0.71	0.61	1.22
12	0.12	0.07	0.23	0.24	0.09	0.19	0.34	0.18	.85
13	0.04	0.05	0.08	0.07	0.07	0.08	0.12	0.07	.31
14+	0.04	0.15	0.16	0.14	0.15	0.27	0.26	0.06	.22
Total	48.54	77.41	39.17	46.20	36.03	50.36	53.26	26.64	127.66

Table 26. Mean number per tow of cod at age from research vessel surveys in Division 3L for strata surveyed in all years (fall surveys).

Age	1981	1982	1983	1984	1985	1986
1	0.41	0.43	0.67	0.36	0.01	.04
2	0.40	2.85	3.67	7.64	1.40	1.07
3	7.04	2.05	13.99	11.53	11.04	2.36
4	2.93	6.85	5.40	19.05	14.69	11.01
5	2.79	2.91	7.80	5.22	12.48	9.49
6	4.17	2.15	1.45	10.61	5.92	9.73
7	5.87	1.79	1.39	1.70	3.92	3.05
8	1.09	1.62	2.42	1.19	.61	2.30
9	0.22	0.30	1.30	1.04	.93	.89
10	0.08	0.09	0.46	1.09	.46	.35
11	0.04	0.05	0.13	0.43	.33	.45
12	0.03	0.06	0.06	0.25	.13	.24
13+	0.13	0.06	0.19	0.18	.08	.17
Total	25.19	21.41	38.94	60.31	52.23	41.13

Table 27. Mean number of cod per tow of cod at age from research vessel surveys in Division 3L for strata ≤ 200 fm.

Age	1977	1978	1979	1980	1981	1982	1985	1986
1	0.0	0.0	0.06	0.09	0.18	0.03	0.0	0.0
2	0.89	0.07	0.08	1.97	0.51	1.72	1.38	0.25
3	4.05	3.31	0.84	0.91	9.24	1.56	12.10	3.43
4	5.82	6.18	9.16	3.54	7.40	9.25	18.12	12.59
5	4.52	4.92	13.89	10.83	6.59	2.34	16.34	12.70
6	2.11	3.18	6.48	8.74	11.28	2.96	8.20	9.25
7	0.63	1.43	1.53	2.21	11.50	4.15	8.11	4.38
8	0.65	0.46	0.46	0.80	3.06	3.08	1.71	3.48
9	0.43	0.39	0.12	0.16	0.79	0.93	0.76	0.77
10	0.15	0.23	0.19	0.07	0.26	0.20	1.07	0.65
11	0.10	0.17	0.08	0.12	0.08	0.07	1.19	1.11
12	0.06	0.12	0.04	0.07	0.08	0.05	0.40	0.70
13+	0.16	0.17	0.18	0.15	0.08	0.26	0.32	0.41
Total	19.54	20.62	33.11	29.68	51.04	26.60	69.70	49.73

Table 28. Age 6+ abundance index for cod in Div. 2J3KL for the period 1978-86 derived from Canadian research vessel surveys.

Year	2J	3K	3L	Ave.
1978	16.80	13.28	(3.16)	9.78
1979	23.14	26.36	(4.35)	16.01
1980	39.11	20.55	(19.24)	24.64
1981	48.65	29.92	11.63	26.69
1982	47.25	19.93	6.12	20.80
1983	43.76	16.97	7.40	19.55
1984	24.37	21.12	16.49	19.93
1985	34.42	10.33	12.58	17.36
1986	87.47	52.16	17.18	45.86
Area	17360	21792	29969	

3L Spring 7+		3L FALL 6+			7+/6+
1982	8.74	1981	11.63		1.331
1985	13.56	1984	16.49		1.216
1986	11.50	1985	12.58		1.094
				Ave.	1.214
1979	2.60	1978	(3.16)		
1980	3.58	1979	(4.35)		
1981	15.85	1980	(19.24)		

Table 29. Recruitment indices from Fall surveys for the period 1978-86.

Year-class	Age 3			Age 4			Age 5		
	2J	3K	3L	2J	3K	3L	2J	3K	3L
1973							33.06	17.40	(5.79)
1974				16.35	14.27	(16.54)	18.96	30.00	(7.80)
1975	8.86	3.27	(6.83)	12.93	18.23	(12.89)	21.67	13.24	(10.07)
1976	1.54	2.68	(2.64)	4.77	2.35	(7.85)	4.57	4.36	2.79
1977	1.40	1.63	(5.51)	2.48	4.00	2.93	5.38	5.78	2.91
1978	3.31	6.38	7.04	7.73	5.86	6.85	19.94	12.72	7.80
1979	21.98	2.08	2.05	31.40	7.22	5.40	32.12	9.43	5.22
1980	20.39	8.53	13.99	19.91	11.70	19.05	16.85	7.03	12.48
1981	20.15	6.77	11.53	27.25	5.16	14.69	82.93	36.12	9.49
1982	11.19	3.35	11.04	36.85	29.94	11.01			
1983	10.01	6.01	2.36						
Survey area (mi^2)	17360	21792	29969						

2J3KL

Year-class	Age 3	Age 4	Age 5
1973			16.30
1974		15.78	17.60
1975	6.22	14.58	13.98
1976	2.38	5.34	3.73
1977	3.25	3.15	4.44
1978	5.90	6.76	12.40
1979	7.06	12.50	13.30
1980	13.88	16.95	11.86
1981	12.19	14.84	36.33
1982	8.65	24.77	
1983	5.43		

Table30 . Analysis of variance and regression coefficients from tne regression of ln catch rate for cod in Div. 2J3KL for the years 1962-79.

Country/Gear	ln Power	Month	ln Power
Can-N OTB-4	-0.333	Jan	0.0000
Can-N OTB-5	0.000	Feb	0.052
ESP OTB-6	0.244	Mar	-0.170
PRT OTB-6	0.333	Apr	-0.056
PRT OTB-7	0.663	May	-0.270
		June	-0.494
		July	-0.699
Division	ln Power	Aug	-0.699
2J	0.000	Sept	-0.709
3K	-0.161	Oct	-0.724
3L	-0.275	Nov	-0.654
		Dec	-0.516

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.773
MULTIPLE R SQUARED..... 0.598

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	4.687E0	4.687E1	
REGRESSION	34	3.925E2	1.154E1	66.174
TYPE 1	4	6.528E1	1.632E1	73.587
TYPE 2	11	1.182E2	1.075E1	61.693
TYPE 3	2	1.767E1	8.834E0	50.660
TYPE 4	17	2.010E2	1.182E1	67.803
RESIDUALS	1515	2.642E2	1.744E-1	
TOTAL	1550	6.613E2		

Table 31 . Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 2J3KL for the years 1978-86.

Country/Gear	ln Power	Month	ln Power
PRT OTB-7	-0.493	Jan	0.000
PRT OTB-6	-0.276	Feb	0.048
Can-N OTB-4	-0.217	Mar	-0.264
Can-N OTB-5	-0.053	Apr	-0.258
Can-M OTB-4	0.000	May	-0.688
Can-M OTB-5	0.398	June	-0.942
		July	-1.048
		Aug.	-1.187
Division	ln Power	Sept	-1.147
2J	0.000	Oct	-1.026
3K	-0.385	Nov	-0.887
3L	-0.736	Dec	-0.600

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.805
MULTIPLE R SQUARED..... 0.654

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	3.132E1	3.132E1	
REGRESSION	25	2.485E2	9.938E0	38.258
TYPE 1	5	3.048E1	6.097E0	23.481
TYPE 2	11	8.022E1	7.292E0	28.081
TYPE 3	2	3.793E1	1.896E1	72.991
TYPE 4	6	4.615E1	5.769E0	22.213
RESIDUALS	539	1.312E2	2.435E-1	
TOTAL	566	4.616E2		

Table 32 . Commercial catch rate index for cod in Div. 2J3KL for the period 1962-79.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1962	0.7408	0.0067	2.281	0.187	502572	220324
1963	0.7867	0.0064	2.389	0.190	509209	213168
1964	0.7194	0.0062	2.233	0.176	602651	269827
1965	0.5564	0.0060	1.898	0.147	545035	287192
1966	0.6129	0.0056	2.008	0.150	524505	261144
1967	0.7033	0.0052	2.199	0.159	611764	278213
1968	0.6518	0.0048	2.089	0.145	810014	387786
1969	0.4517	0.0050	1.710	0.120	753690	440762
1970	0.3057	0.0052	1.477	0.106	520226	352114
1971	0.1279	0.0052	1.237	0.089	439518	355374
1972	0.0093	0.0054	1.098	0.081	458295	417252
1973	0.0007	0.0060	1.089	0.085	354509	325645
1974	0.1114	0.0065	1.216	0.098	372650	306519
1975	0.1578	0.0059	1.274	0.098	287508	225693
1976	-0.0629	0.0076	1.021	0.089	214220	209868
1977	-0.5887	0.0056	0.604	0.045	172720	285973
1978	-0.5693	0.0063	0.616	0.049	138559	225085
1979	0.0876	0.0058	1.188	0.091	166899	140529

Table 33 . Commercial catch rate index for cod in Div. 2J3KL for the period 1978-86.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	0.6412	0.0130	2.131	0.242	138559	65016
1979	0.9682	0.0098	2.960	0.293	166899	56381
1980	1.1409	0.0099	3.519	0.349	175788	49967
1981	1.3638	0.0095	4.397	0.428	170712	38820
1982	1.2891	0.0082	4.084	0.369	229774	56268
1983	1.4603	0.0081	4.846	0.436	232345	47942
1984	1.5908	0.0089	5.520	0.520	230387	41740
1985	1.7620	0.0099	6.547	0.652	231568	35371
1986	1.6440	0.0103	5.817	0.590	251517	43238

Table 34. Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 2J for the years 1962-79.

Country/Gear		ln Power	Month	ln Power
ESP	OTB-6	-0.286	Jan	0.000
PRT	OTB-6	-0.130	Feb	0.003
Can-N	OTB-4	-0.056	Mar	-0.287
Can-N	OTB-5	0.000	Apr	-0.147
PRT	OTB-7	0.220	May	-0.356
			June	-0.562
			July	-1.107
			Aug.	-0.910
			Sept.	-0.896
			Oct	-0.959
			Nov	-0.880
			Dec	-0.468

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.851
MULTIPLE R SQUARED..... 0.725

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	5.103E1	5.103E1	
REGRESSION	32	1.197E2	3.740E0	30.503
TYPE 1	4	1.134E1	2.835E0	23.201
TYPE 2	11	4.903E1	4.458E0	36.481
TYPE 3	17	7.647E1	4.498E0	36.811
RESIDUALS	372	4.546E1	1.222E-1	
TOTAL	405	2.162E2		

Table 35 . Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 2J for the years 1978-86.

Country/Gear	ln Power	Month	ln Power
Can-M OTB-4	0.000	Jan	0.000
PRT OTB-6	0.237	Feb	-0.232
PRT OTB-7	0.399	Mar	-0.317
Can-N OTB-5	0.774	Apr	-0.051
Can-N OTB-4	0.971	May	-0.640
Can-M OTB-5	1.112	June	-1.065
		July	-1.473
		Aug.	-2.196
		Sept.	-2.012
		Oct	-2.916
		Nov	-1.725
		Dec	-1.305

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.902
MULTIPLE R SQUARED..... 0.814

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	7.505E1	7.505E1	
REGRESSION	24	6.408E1	2.670E0	15.631
TYPE 1	9	8.351E0	1.670E0	9.779
TYPE 2	11	3.194E1	2.904E0	17.004
TYPE 3	3	1.819E1	2.274E0	13.312
RESIDUALS	86	1.469E1	1.708E-1	
TOTAL	111	1.538E2		

Table 36. Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 3K for the years 1962-79.

Country/Gear	ln Power	Month	ln Power
ESP OTB-6	-0.098	Jan	0.000
PRT OTB-6	-0.094	Feb	0.032
Can-N OTB-5	0.000	Mar	-0.156
Can-N OTB-4	0.103	Apr	-0.086
PRT OTB-7	0.247	May	-0.218
		June	-0.416
		July	-0.785
		Aug.	-0.822
		Sept.	-0.740
		Oct.	-0.696
		Nov	-0.656
		Dec.	-0.439

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.765
MULTIPLE R SQUARED..... 0.585

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	9.429E1	9.429E1	
REGRESSION	32	9.591E1	2.997E0	19.317
TYPE 1	4	7.231E0	1.808E0	11.651
TYPE 2	11	3.675E1	3.341E0	21.532
TYPE 3	17	7.222E1	4.248E0	27.380
RESIDUALS	438	6.796E1	1.552E-1	
TOTAL	471	1.648E2		

Table 37 . Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 3K for the years 1978-86.

Country/Gear	ln Power	Month	ln Power
PRT OTB-7	-0.455	Jan	0.000
PRT OTB-6	-0.150	Feb	0.128
Can-M OTB-4	0.000	Mar	-0.227
Can-N OTB-4	0.071	Apr	-0.315
Can-N OTB-5	0.091	May	-0.534
Can-M OTB-5	0.451	June	-0.856
		July	-1.086
		Aug.	-2.231
		Sept	-1.606
		Oct	-1.325
		Nov	-1.173
		Dec	-0.770

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.881
MULTIPLE R SQUARED..... 0.776

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	9.044E1	9.044E1	
REGRESSION	24	7.858E1	3.274E0	23.469
TYPE 1	5	6.391E0	1.278E0	9.170
TYPE 2	11	2.860E1	2.600E0	18.650
TYPE 3	8	3.893E1	4.867E0	34.915
RESIDUALS	163	2.272E1	1.394E-1	
TOTAL	188	1.917E2		

Table 38. Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 3L for the years 1962-79.

Country/Gear	ln Power	Month	ln Power
Can-N OTB-4	-0.268	Jan	0.000
Can-N OTB-5	0.000	Feb	0.006
ESP OTB-6	0.414	Mar	-0.098
PRT OTB-6	0.524	Apr	0.026
PRT OTB-7	0.831	May	-0.262
		June	-0.483
		July	-0.552
		Aug	-0.511
		Sept.	-0.566
		Oct	-0.625
		Nov	-0.493
		Dec	-0.496

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.752
MULTIPLE R SQUARED..... 0.566

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.630E1	1.630E1	
REGRESSION	32	1.496E2	4.674E0	26.108
TYPE 1	4	5.910E1	1.477E1	82.518
TYPE 2	11	3.652E1	3.320E0	18.547
TYPE 3	17	7.262E1	4.272E0	23.859
RESIDUALS	641	1.148E2	1.791E-1	
TOTAL	674	2.811E2		

Table 39 . Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 3L for the years 1978-86.

Country/Gear	ln Power	Month	ln Power
PRT OTB-7	-0.548	Jan	0.000
Can-N OTB-4	-0.436	Feb	0.426
Can-N OTB-5	-0.191	Mar	0.034
Prt OTB-6	-0.159	Apr	-0.142
Can-M OTB-4	0.000	May	-0.645
Can-M OTB-5	0.354	June	-0.852
		July	-0.777
		Aug.	-0.763
		Sept.	-0.683
		Oct.	-0.706
		Nov.	-0.520
		Dec.	-0.188

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.821
MULTIPLE R SQUARED..... 0.674

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.875E1	1.875E1	
REGRESSION	24	6.563E1	2.734E0	20.852
TYPE 1	5	1.386E1	2.771E0	21.133
TYPE 2	11	3.323E1	3.021E0	23.050
TYPE 3	8	8.250E0	1.031E0	7.868
RESIDUALS	242	3.173E1	1.311E-1	
TOTAL	267	9.755E1		

Table 40 . Commercial catch rate index for cod in Div. 2J for the period 1962-79.

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	S.E.	RETRANSFORMED MEAN	S.E.	CATCH	EFFORT
1962	1.3438	0.0106	4.054	0.417	250265	61729
1963	1.2571	0.0102	3.718	0.378	211693	56937
1964	1.1422	0.0101	3.315	0.333	195032	58837
1965	1.0678	0.0091	3.141	0.299	252323	80339
1966	1.0603	0.0084	3.057	0.280	243688	79724
1967	1.1648	0.0082	3.394	0.306	240076	70736
1968	1.1403	0.0077	3.313	0.291	340809	102884
1969	1.0190	0.0078	2.934	0.260	360901	123014
1970	0.7456	0.0084	2.232	0.204	198786	89082
1971	0.6349	0.0080	1.998	0.179	150216	75188
1972	0.4255	0.0098	1.619	0.160	149763	92499
1973	0.4190	0.0115	1.607	0.172	57727	35918
1974	0.7481	0.0133	2.231	0.257	121267	54344
1975	0.7860	0.0106	2.321	0.238	81988	35325
1976	-0.2719	0.0709	0.782	0.205	34636	44302
1977	-0.3338	0.0131	0.756	0.087	43632	57681
1978	-0.5751	0.0130	0.594	0.068	28866	48571
1979	0.2380	0.0196	1.336	0.186	24175	18099

Table 41 . Commercial catch rate index for cod in Div. 2J for the period 1978-86.

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	S.E.	RETRANSFORMED MEAN	S.E.	CATCH	EFFORT
1978	-0.1025	0.0410	0.964	0.194	28866	29949
1979	0.7620	0.0225	2.310	0.348	24175	10467
1980	0.8174	0.0265	2.436	0.396	38237	15695
1981	1.5665	0.0303	5.143	0.893	41136	7999
1982	1.2576	0.0203	3.795	0.541	81736	21537
1983	1.8503	0.0234	6.854	1.048	51619	7531
1984	1.5449	0.0303	5.033	0.874	25289	5025
1985	1.4250	0.0424	4.437	0.909	11559	2605
1986	1.2499	0.0574	3.696	0.878	24578	6650

Table 42 . Commercial catch rate index for cod in Div. 3K for the period 1962-79.

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1962	0.7894	0.0163	2.361	0.301	88370	37432
1963	0.9226	0.0145	2.700	0.324	122830	45498
1964	0.9064	0.0144	2.656	0.318	151622	57078
1965	0.7199	0.0142	2.205	0.262	72634	32946
1966	0.6561	0.0139	2.069	0.243	89764	43393
1967	0.8465	0.0136	2.503	0.291	101919	40719
1968	0.6914	0.0132	2.144	0.246	156740	73116
1969	0.5682	0.0114	1.897	0.202	99376	52387
1970	0.4384	0.0136	1.664	0.194	91000	54684
1971	0.1877	0.0130	1.296	0.147	79546	61401
1972	0.2435	0.0129	1.370	0.155	146183	106704
1973	0.1801	0.0126	1.286	0.144	172951	134494
1974	0.2192	0.0130	1.337	0.152	159955	119640
1975	0.3557	0.0110	1.534	0.161	128385	83688
1976	0.2380	0.0173	1.359	0.178	101190	74434
1977	-0.6013	0.0119	0.589	0.064	56788	96427
1978	-0.6963	0.0152	0.535	0.066	43023	80469
1979	-0.0391	0.0152	1.031	0.127	65483	63484

Table 43 . Commercial catch rate index for cod in Div. 3K for the period 1962-79.

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1978	0.0133	0.0154	1.079	0.134	43023	39889
1979	0.6463	0.0105	2.036	0.209	65483	32157
1980	0.7439	0.0156	2.239	0.279	65763	29368
1981	1.1974	0.0129	3.529	0.401	49961	14157
1982	0.9627	0.0155	2.787	0.347	55096	19767
1983	1.0143	0.0109	2.941	0.307	74720	25403
1984	1.6157	0.0096	5.371	0.527	93093	17333
1985	1.7151	0.0097	5.932	0.585	108528	18296
1986	1.3046	0.0101	3.934	0.396	89004	22626

Table 44 . Commercial catch rate index for cod in Div. 3L for the period 1962-79.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1962	0.7300	0.0176	2.250	0.297	164117	72944
1963	0.8546	0.0153	2.551	0.314	156361	61287
1964	0.7576	0.0143	2.317	0.276	215099	92847
1965	0.5349	0.0137	1.855	0.216	185825	100191
1966	0.6300	0.0129	2.041	0.231	181474	88933
1967	0.7146	0.0116	2.222	0.239	258205	116199
1968	0.6319	0.0113	2.046	0.217	266112	130054
1969	0.4501	0.0117	1.706	0.184	229182	134377
1970	0.3557	0.0117	1.552	0.167	196559	126659
1971	0.1116	0.0122	1.215	0.134	190755	156941
1972	-0.0093	0.0108	1.078	0.112	158644	147186
1973	-0.0027	0.0126	1.084	0.121	123831	114232
1974	0.0308	0.0150	1.120	0.137	91428	81661
1975	0.0111	0.0121	1.099	0.121	77135	70165
1976	-0.0881	0.0141	0.995	0.118	78394	78827
1977	-0.3397	0.0118	0.774	0.084	72443	93572
1978	-0.1430	0.0197	0.939	0.131	66670	71018
1979	0.1356	0.0161	1.243	0.157	77233	62155

Table 45 . Commercial catch rate index for cod in Div. 3L for the period 1978-86.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	0.5264	0.0212	1.789	0.260	66670	37271
1979	0.4717	0.0164	1.698	0.217	77233	45494
1980	0.6253	0.0170	1.979	0.257	71782	36272
1981	0.6665	0.0143	2.065	0.247	79651	38571
1982	0.6591	0.0139	2.050	0.241	92942	45333
1983	0.7413	0.0115	2.229	0.238	103874	46611
1984	0.8037	0.0116	2.372	0.255	112005	47218
1985	1.0177	0.0140	2.934	0.346	111451	37980
1986	1.0613	0.0130	3.067	0.349	137935	44979

Table 46 . Catch rate indices for Div. 2J3KL cod analyzed in two time periods (1962-79, 1978-86) and combined using overlapping years (1978-79).

Year	2J	3K	3L	2J3KL
1962	4.20	3.02	2.06	2.53
1963	3.85	3.45	2.34	2.65
1964	3.44	3.39	2.12	2.48
1965	3.25	2.82	1.70	2.10
1966	3.17	2.64	1.87	2.23
1967	3.51	3.20	2.04	2.44
1968	3.43	2.74	1.88	2.32
1969	3.04	2.42	1.57	1.90
1970	2.31	2.13	1.42	1.63
1971	2.07	1.66	1.11	1.37
1972	1.68	1.75	0.99	1.22
1973	1.67	1.64	0.99	1.21
1974	2.31	1.71	1.03	1.35
1975	2.40	1.96	1.01	1.41
1976	0.81	1.74	0.91	1.13
1977	0.78	0.75	0.71	0.67
1978	0.59	0.69	1.03	0.84
1979	1.41	1.31	0.97	1.16
1980	1.49	1.44	1.14	1.38
1981	3.14	2.27	1.18	1.73
1982	2.32	1.79	1.18	1.60
1983	4.19	1.89	1.28	1.90
1984	3.07	3.45	1.36	2.17
1985	2.71	3.81	1.68	2.57
1986	2.26	2.53	1.76	2.29

Table 47. NAFO Div. 2J3KL catch rates of cod analyzed by division and combined using survey biomass estimates compared with catch rates standardized using the multiplicative model.

Year	2J	3K	3L	2J3KL	Standardized 2J3KL
1978	0.964	1.079	1.789	1.222	2.131
1979	2.310	2.036	1.698	2.060	2.960
1980	2.436	2.239	1.979	2.252	3.518
1981	5.143	3.529	2.065	3.811	4.397
1982	3.795	2.787	2.050	3.011	4.084
1983	6.854	2.941	2.229	4.392	4.846
1984	5.033	5.371	2.372	4.419	5.520
1985	4.437	5.932	2.934	4.495	6.547
1986	3.696	3.934	3.067	3.600	5.817
% Biomass [a]	42	31	27	100	

a)% Biomass averaged over the period 1981-86 (From Fall Surveys)

Relationship

Slope	0.758
Intercept	-0.103
r^2	0.83

Table 48. Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 2J3KL for the years 1962-79 and excluding data from the first quarter.

Country/Gear	ln Power	Month	ln Power
Can-N OTB-4	-0.357	Apr	0.000
Can-N OTB-5	0.000	May	-0.225
ESP OTB-6	0.257	June	-0.441
PRT OTB-6	0.367	July	-0.648
PRT OTB-7	0.705	Aug	-0.640
		Sept	-0.653
		Oct	-0.683
Division	ln Power	Nov	-0.612
2J	0.000	Dec	-0.455
3K	-0.133		
3L	-0.230		

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.767
MULTIPLE R SQUARED..... 0.588

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	4.072E+1	4.072E+1	
REGRESSION	31	2.507E2	8.089E0	52.44
TYPE 1	4	5.333E1	1.333E1	86.44
TYPE 2	8	6.352E1	7.939E0	51.47
TYPE 3	2	9.126E0	4.563E0	29.58
TYPE 4	17	1.303E2	7.666E0	49.70
RESIDUALS	1141	1.760E2	1.542E-1	
TOTAL	1173	4.271E2		

Table 49. Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 2J3KL for the years 1978-86 and excluding data from the first quarter.

Country/Gear	ln Power	Month	ln Power
Can-N OTB-4	-0.332	Apr	0.000
PRT OTB-7	-0.295	May	-0.460
PRT OTB-6	-0.166	June	-0.659
Can-N OTB-5	-0.109	July	-0.758
Can-M OTB-4	0.000	Aug.	-0.912
Can-M OTB-5	0.404	Sept	-0.829
		Oct	-0.754
		Nov.	-0.574
Division	ln Power	Dec	-0.343
2J	0.000		
3K	-0.378		
3L	-0.704		

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.777
MULTIPLE R SQUARED..... 0.604

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	9.653E0	9.653E0	
REGRESSION	23	1.124E2	4.886E0	24.983
TYPE 1	5	2.125E1	4.250E0	21.728
TYPE 2	8	2.675E1	3.344E0	17.098
TYPE 3	2	2.093E1	1.047E1	53.520
TYPE 4	8	1.696E1	2.120E0	10.838
RESIDUALS	377	7.373E1	1.956E-1	
TOTAL	401	1.959E2		

Table 50 . Commercial catch rate index for cod in Div. 2J3KL for the period 1962-79 (Analysis conducted excluding data from the first quarter).

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1962	0.5292	0.0042	1.830	0.118	502572	274631
1963	0.6090	0.0037	1.982	0.121	509209	256853
1964	0.4882	0.0036	1.757	0.105	602651	343022
1965	0.3233	0.0037	1.490	0.091	545035	365864
1966	0.4413	0.0034	1.677	0.098	524505	312820
1967	0.5910	0.0032	1.948	0.110	611764	314106
1968	0.4935	0.0033	1.767	0.101	810014	458532
1969	0.1837	0.0032	1.296	0.073	753690	581519
1970	0.1331	0.0032	1.232	0.070	520226	422239
1971	-0.0924	0.0033	0.983	0.057	439518	447019
1972	-0.1688	0.0035	0.911	0.054	458295	503171
1973	-0.1477	0.0036	0.930	0.056	354509	381088
1974	-0.0331	0.0046	1.043	0.071	372650	357397
1975	-0.1125	0.0047	0.963	0.066	287508	298541
1976	-0.2903	0.0066	0.805	0.065	214220	265991
1977	-0.5737	0.0051	0.607	0.043	172720	284505
1978	-0.7341	0.0069	0.517	0.043	138559	268197
1979	-0.1537	0.0055	0.924	0.069	166899	180667

Table 51. Commercial catch rate index for cod in Div. 2J3KL for the period 1978-86 (Analysis conducted excluding data from the first quarter).

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1978	-0.5601	0.0132	0.626	0.072	138559	221397
1979	-0.4709	0.0092	0.686	0.066	166899	243428
1980	-0.2555	0.0089	0.851	0.080	175788	206680
1981	-0.2536	0.0090	0.852	0.081	170712	200351
1982	-0.1624	0.0070	0.934	0.078	229774	245902
1983	-0.1378	0.0075	0.957	0.083	232345	242672
1984	-0.0225	0.0075	1.074	0.093	230387	214424
1985	0.1636	0.0070	1.295	0.108	231568	178885
1986	0.1243	0.0083	1.244	0.113	251517	202210

Table 52. Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 2J3KL for the years 1962-79 and excluding data from the first and second quarters.

Country/Gear		ln Power	Month	ln Power
Can-N	OTB-4	-0.122	July	0.000
Can-N	OTB-5	0.000	Aug	0.024
ESP	OTB-6	0.299	Sept	0.013
PRT	OTB-6	0.372	Oct	-0.017
PRT	OTB-7	0.656	Nov	0.049
			Dec	0.201

Division	ln Power
2J	0.000
3K	-0.128
3L	-0.197

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.685
MULTIPLE R SQUARED..... 0.471

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	FVALUE
INTERCEPT	1	1.320E1	1.320E1	
REGRESSION	28	9.152E1	3.269E0	21.682
TYPE 1	4	1.894E1	4.735E0	31.404
TYPE 2	5	2.902E0	5.803E-1	3.850
TYPE 3	2	4.067E0	2.033E0	13.487
TYPE 4	17	6.550E1	3.853E0	25.557
RESIDUALS	682	1.028E2	1.508E-1	
TOTAL	711	2.075E2		

Table 53 . Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Div. 2J3KL for the years 1978-86 and excluding data from the first and second quarters.

Country/Gear	ln Power	Month	ln Power
PRT OTB-7	-0.701	July	0.000
Can-N OTB-4	-0.523	Aug.	-0.202
PRT OTB-6	-0.359	Sept	-0.125
Can-N OTB-5	-0.352	Oct	-0.084
Can-M OTB-4	0.000	Nov	0.071
Can-M OTB-5	0.328	Dec	0.383

Division	ln Power
2J	0.000
3K	-0.170
3L	-0.236

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.720
MULTIPLE R SQUARED..... 0.518

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	5.997E+1	5.997E+1	
REGRESSION	20	2.937E+1	1.469E+0	9.570
TYPE 1	5	1.194E+1	2.388E+0	15.562
TYPE 2	5	7.538E+0	1.508E+0	9.824
TYPE 3	2	7.971E+1	3.986E+1	2.597
TYPE 4	8	3.837E+0	4.797E+1	3.125
RESIDUALS	178	2.732E+1	1.535E+1	
TOTAL	199	5.729E+1		

Table 54 . Commercial catch rate index for cod in Div. 2J3KL for the period 1962-79 (Analysis conducted excluding data from the first and second quarters).

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1962	0.0413	0.0054	1.121	0.082	502572	448389
1963	0.0761	0.0052	1.161	0.084	509209	438734
1964	-0.0285	0.0051	1.045	0.075	602651	576449
1965	-0.1036	0.0050	0.970	0.068	545035	561989
1966	0.1012	0.0046	1.191	0.080	524505	440561
1967	0.2524	0.0040	1.385	0.087	611764	441627
1968	0.2080	0.0045	1.325	0.089	810014	611460
1969	-0.1474	0.0045	0.929	0.062	753690	811717
1970	-0.1887	0.0044	0.891	0.059	520226	583858
1971	-0.4034	0.0047	0.719	0.050	439518	611553
1972	-0.5408	0.0052	0.626	0.045	458295	731700
1973	-0.5957	0.0055	0.593	0.044	354509	598047
1974	-0.4645	0.0095	0.675	0.065	372650	552463
1975	-0.5202	0.0054	0.639	0.047	287508	449734
1976	-0.7136	0.0092	0.526	0.050	214220	407388
1977	-0.8043	0.0101	0.480	0.048	172720	359804
1978	-0.9310	0.0147	0.422	0.051	138559	328371
1979	-0.5092	0.0096	0.645	0.063	166899	258752

Table 55. Commercial catch rate index for cod in Div. 2J3KL for the period 1978-86 (Analysis conducted excluding data from the first and second quarters).

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	-0.1702	0.0243	0.900	0.140	138559	153932
1979	-0.0200	0.0149	1.051	0.128	166899	158803
1980	-0.0048	0.0182	1.065	0.144	175788	165017
1981	-0.0096	0.0105	1.064	0.109	170712	160409
1982	-0.0940	0.0118	0.978	0.106	229774	235058
1983	0.0706	0.0087	1.154	0.108	232345	201306
1984	0.1556	0.0091	1.256	0.120	230387	183379
1985	0.2691	0.0090	1.407	0.133	231568	164535
1986	0.3258	0.0097	1.489	0.146	251517	168911

Table 56. Relationships of standardized catch rates excluding first quarter and first and second quarters with standardized catch for the entire year for cod in Div. 2J3KL in two time periods (1962-79, 1978-86).

Year	2J3KL Jan.-Dec.	2J3KL Apr.-Dec.	2J3KL Jul.-Dec.
1962	1.486	1.454	1.316
1963	1.556	1.575	1.362
1964	1.455	1.395	1.227
1965	1.236	1.183	1.138
1966	1.308	1.332	1.397
1967	1.432	1.547	1.626
1968	1.361	1.403	1.555
1969	1.114	1.029	1.090
1970	0.962	0.979	1.046
1971	0.806	0.781	0.844
1972	0.716	0.723	0.735
1973	0.709	0.739	0.696
1974	0.792	0.828	0.792
1975	0.832	0.765	0.750
1976	0.665	0.640	0.617
1977	0.393	0.482	0.563
1978	0.401	0.410	0.495
1979	0.774	0.734	0.757
Slope		0.989	0.885
Intercept		0.011	0.116
r^2		0.98	0.89
1978	0.482	0.661	0.781
1979	0.669	0.724	0.912
1980	0.795	0.898	0.925
1981	0.994	0.900	0.924
1982	0.923	0.987	0.849
1983	1.095	1.011	1.002
1984	1.248	1.135	1.091
1985	1.480	1.367	1.222
1986	1.315	1.313	1.293
Slope		0.725	0.474
Intercept		0.275	0.523
r^2		0.94	0.80

Table 57. Catch rates of cod in Div. 2J3KL for first quarter for Can-N tonnage class 5 vessels for the period 1978-87.

Year	2J		3K		3L	
	C	E	C	E	C	E
1978	3864	2920	2147	2959	239	400
1979	5379	2319	9508	5193	827	805
1980	6337	3289	4461	3556	4569	3253
1981	15776	2726	13986	3467	4699	3051
1982	22146	5929	2471	1296	3337	2527
1983	17430	1989	6522	3154	8629	4950
1984	2506	402	15508	3132	18298	10403
1985	14	11	16890	3440	906	223
1986	2385	471	30354	9232	5455	2212
1987	9641	3533	18645	3727	587	261

Catch Rate

Year	2J	3K	3L
1978	1.323	0.726	0.598
1979	2.320	1.831	1.027
1980	1.927	1.255	1.405
1981	5.787	4.034	1.540
1982	3.735	1.907	1.321
1983	8.763	2.068	1.743
1984	6.234	4.952	1.759
1985	-	4.910	4.063
1986	5.064	3.288	2.466
1987	2.729	5.003	2.215

Table 58. Catch rates of cod in Div. 2J3KL for first quarter for Can-N tonnage class 5 vessels for the period 1983-87. Included are the number of hours of observed effort from which catch rates are calculated.

A) Catch rates (t/hr)

	2J			3K			3L		
	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
1983	16.3	11.3	3.4	2.3	1.6	3.2	1.6	1.6	1.9
1984	-	-	-	4.5	3.9	3.9	2.7	3.4	1.3
1985	-	-	-	23.6	6.4	5.0	-	6.0	-
1986	7.9	-	1.4	3.8	5.9	2.4	1.8	1.4	2.6
1987	2.5	2.6	3.3	7.2	4.2	2.0	3.4	0.0	0.2

B) Observed effort (hrs)

	2J			3K			3L		
	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
1983	73	128	100	100	47	243	125	145	208
1984	-	-	-	32	156	167	174	135	175
1985	-	-	-	4	83	298	-	25	-
1986	11	-	25	495	383	674	19	13	478
1987	1155	1423	2789	960	1832	214	44	1	62

Table 59. Number of purchase slips along with inshore and nearshore catches by gear for cod in NAFO Div. 2J.

Year	Inshore (<35')				Nearshore (35-64')			
	Trap	GN	Jigger +HL	LT	Trap	GN	Jigger +HL	LT
Purchase Slips								
1979	-	-	-	-	10	1591	5	10
1980	-	-	-	-	22	2962	7	15
1981	418	1630	511	96	78	3354	10	66
1982	679	1811	824	115	56	2884	28	20
1983	721	1115	940	99	107	1545	66	7
1984	1505	2644	1664	269	107	2104	53	32
1985	1771	1180	2585	353	152	944	206	27
1986	1822	5567	1541	151	110	1298	46	19
Catches								
1979					9	3734	1	18
1980					53	6817	6	19
1981	3715	1379	179	32	178	8303	4	40
1982	4127	2508	713	101	136	6129	24	13
1983	3675	1444	1144	293	171	3316	32	4
1984	5331	2265	978	108	285	3771	60	24
1985	4620	1200	1774	148	317	1750	175	32
1986	4210	4822	539	39	131	2760	22	19
Catch per slip								
1979					.90	2.35	.20	1.80
1980					2.41	2.30	.86	1.27
1981	8.89	.85	.35	.33	2.28	2.48	.40	.61
1982	6.08	1.38	.87	.88	2.43	2.13	.86	.65
1983	5.10	1.30	1.22	2.96	1.60	2.15	.48	.57
1984	3.54	.86	.59	.40	2.66	1.79	1.13	.75
1985	2.61	1.02	.69	.42	2.09	1.85	.85	1.19
1986	2.31	.87	.35	.26	1.19	2.13	.48	1.00

Table 60. Number of purchase slips along with inshore and nearshore catches by gear for cod in NAFO Div. 3K

Year	Inshore (35')				Nearshore (35-64')			
	Trap	GN	Jigger +HL	LT	Trap	GN	Jigger +HL	LT
Purchase Slips								
1979	-	-	-	-	832	9872	240	753
1980	-	-	-	-	1187	9194	43	621
1981	3953	12262	5937	23533	771	8244	65	647
1982	12288	16679	4590	18498	1881	7838	38	453
1983	10679	21418	33405	6256	1396	7472	962	90
1984	10373	22076	35202	6432	1021	6356	559	104
1985	18833	18555	28562	5760	1152	3711	416	61
1986	20391	19108	24868	5128	1329	3635	235	107
Catch								
1979	-	-	-	-	1241	5688	138	576
1980	-	-	-	-	2029	5378	25	816
1981	3440	4634	1991	5992	819	5117	21	365
1982	12538	10016	2043	5660	3885	7342	11	406
1983	8950	9987	8601	2142	2696	8125	713	83
1984	7764	7997	8066	3341	2192	6192	275	154
1985	10924	5448	6088	2143	2380	2603	224	122
1986	11624	5288	4545	1382	2965	2325	134	35
Catch per slip								
1979	-	-	-	-	1.49	.58	.58	.76
1980	-	-	-	-	1.71	.58	.58	1.31
1981	0.87	0.38	0.34	0.25	1.06	.62	.32	.56
1982	1.02	0.60	0.45	0.31	2.07	.94	.29	.90
1983	0.84	0.47	0.26	0.34	1.93	1.09	.74	.92
1984	0.75	0.36	0.23	0.52	2.15	.97	.49	1.48
1985	0.58	0.29	0.21	0.37	2.07	.70	.54	2.00
1986	0.57	0.28	0.18	0.27	2.18	.64	.57	.33

Table 61. Numbers of purchase slips along with inshore and nearshore catches by gear for cod in NAFO Div. 3L.

Year	(Inshore (35') Trap	GN	Jigger +HL	LT	Nearshore (35-64') Trap	GN	Jigger +HL	LT
Purchase Slips								
1979	-	-	-	-	1901	6664	126	1082
1980	-	-	-	-	1405	7016	184	1712
1981	10911	15796	18350	15965	1783	8481	321	2783
1982	19007	20722	13836	10290	2815	8156	221	1214
1983	21382	17850	20116	5339	3059	6032	760	879
1984	23152	18248	20402	4332	2698	5084	527	647
1985	16518	12475	15582	2583	2049	3370	373	439
1986	12983	11235	11228	3151	1272	2081	275	225
Catch								
1979	-	-	-	-	4390	6343	59	2139
1980	-	-	-	-	2751	4262	109	2599
1981	8092	6053	7453	7390	2086	6055	189	3906
1982	19178	10674	6150	4390	4929	9586	145	1256
1983	19413	8242	8421	2696	6269	7890	605	1126
1984	18732	8290	7106	2544	4400	6663	334	1030
1985	16483	5176	5511	1717	5048	3574	137	506
1986	12115	4853	3972	1764	3487	3287	141	312
Catch per slip								
1979	-	-	-	-	2.31	0.95	0.47	1.98
1980	-	-	-	-	1.96	0.61	0.59	1.52
1981	.74	.38	.41	.46	1.17	0.71	0.59	1.40
1982	1.01	.52	.44	.43	1.75	1.18	0.66	0.97
1983	.91	.46	.42	.50	2.05	1.31	0.80	1.28
1984	.81	.45	.35	.59	1.63	1.31	0.63	1.59
1985	1.00	.41	.35	.66	2.46	1.06	0.37	1.15
1986	.93	.43	.35	.56	2.74	1.14	0.51	1.39

Table 62. Selectivity coefficients for cod in NAFO Div. 2J3KL for the period 1962-86.

SELECTIVITY COEFFICIENTS

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
4	0.16	0.17	0.13	0.00	0.22	0.20	0.28	0.09	0.21	0.30	0.40	0.32	0.19	0.15	0.19	0.46	0.13	0.11
5	0.32	0.54	0.33	0.24	0.51	0.41	0.66	0.32	0.37	0.65	0.71	0.84	0.45	0.43	0.45	0.84	0.41	0.45
6	0.56	0.95	0.57	0.46	0.68	0.74	0.86	0.73	0.75	0.96	0.87	0.68	0.79	0.71	0.67	0.86	0.75	0.57
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

AGE	1980	1981	1982	1983	1984	1985	1986
4	0.35	0.18	0.25	0.11	0.11	0.13	0.17
5	0.60	0.50	0.50	0.49	0.38	0.47	0.67
6	0.94	0.71	0.62	0.85	0.72	0.67	0.97
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 63. Results of calibration of fall age 6+ survey abundance (1978-86) with the abundance ($X10^{-5}$) in the following year of 7+ Cod as estimated from cohort analysis.

Year	Survey age 6+	F_t = 0.20 Obs.	Res.	F_t = 0.25 Obs.	Res.	F_t = 0.30 Obs.	Res.	F_t = 0.35 Obs.	Res.
1978	9.78	533	-318	533	-378	533	-420	533	-450
1979	16.01	1170	-267	1170	-178	1170	-118	1170	-76
1980	24.64	1683	-567	1650	-302	1629	-123	1613	3
1981	26.69	2026	-417	1951	-144	1900	38	1864	167
1982	20.80	1656	-232	1554	-129	1486	-60	1438	-10
1983	19.55	1476	-294	1342	-253	1252	-227	1188	-207
1984	19.93	2277	470	1970	348	1765	266	1619	208
1985	17.36	2998	1433	2460	1018	2103	742	1848	545
1986	45.86	4441	193	3455	19	2794	-98	2326	-180
r^2		0.70		0.7237		0.7249		0.69	
slope		94		70		54		42	
intercept		-70		228		428		570	

Table 64. Results of calibration of cohort analysis using standardized catch rate versus offshore exploitable biomass (000't) for the years 1962-86.

Year	Catch rate	F_t = 0.10 Obs.	Res.	F_t = 0.15 Obs.	Res.	F_t = 0.20 Obs.	Res.
1962	2.53	13619	-15				
1963	2.65	15978	1550				
1964	2.48	12846	-456				
1965	2.10	9486	-1300				
1966	2.23	11374	-272				
1967	2.44	10981	-2057				
1968	2.32	12725	483				
1969	1.90	8535	-925				
1970	1.63	9035	1363				
1971	1.37	10025	4075				
1972	1.22	8427	3470				
1973	1.21	5674	783				
1974	1.35	3592	-2226				
1975	1.41	2206	-4009				
1976	1.13	1325	-3035				
1977	0.67	2710	1397				
1978	0.84	2720	280				
1979	1.16	4804	245				
1980	1.38	7013	996	6804	1028	6700	1050
1981	1.73	6772	-1563	6485	-1297	6225	-1276
1982	1.60	5394	-2079	4930	-2107	4696	-2117
1983	1.90	6242	-2318	5601	-3155	5078	-3321
1984	2.17	9660	-1589	7519	-2785	6444	-3382
1985	2.57	12190	-1709	8698	-3898	6950	-4990
1986	2.29	21455	9411	14348	3357	10793	333
	r^2	0.66		0.67		0.61	
	slope	6624		5731		5295	
	intercept	-3124		-2134		-1644	

Table 65. Results of calibration of cohort analysis using standardized catch rate versus offshore exploitable biomass for the years 1978-86.

Year	Catch rate	F_t = 0.15 Obs.	Res.	F_t = 0.17 Obs.	Res.	F_t = 0.20 Obs.	Res.
1978	2.13	2720	-222	2720	-489	2720	-790
1979	2.96	4805	440	4805	411	4805	378
1980	3.52	6804	1479	6755	1562	6700	1655
1981	4.40	6485	-350	6362	-88	6225	207
1982	4.08	4930	-1356	4820	-1173	4696	-968
1983	4.85	5601	-2006	5355	-1738	5078	-1437
1984	5.52	7519	-1237	7014	-1036	6444	-811
1985	6.55	8698	-1825	7876	-1645	6950	-1442
1986	5.82	14348	5077	12676	4197	10793	3207
	r^2	0.55		0.54		0.50	
	slope	1715		1428		1105	
	intercept	-713		167		1156	

Table 66. Relationship of age 3 survey recruitment index to age 4 conort abundance at the beginning of the following year for the 1975-79 year-classes.

Year-class	Age 3 survey	Age 4 conort
75	6.22	273
76	2.38	147
77	3.25	156
78	5.90	403
79	7.06	389
Slope		54.12
Intercept		5.05
r^2		0.80
Estimates for the 80-83 year-classes		
1980	13.88	473[a]
1981	12.19	473[a]
1982	8.65	473
1983	5.43	299

[a]Outside the range of observations set at the 1982 level.

Table 67. Comparison of year-class sizes from cohort analyses using average partial recruitment and partial recruitment adjusted to reconcile year-class strengths.

Year-class	Year-class size estimated by Average PR	Adjusted PR
1980	583.8	475.2
1981	613.3	469.6
1982	407.5	477.9

Age	Partial recruitment vectors Average PR	Adjusted PR
3		
4	0.20	0.17
5	0.50	0.67
6	0.75	0.97
7	1.00	1.00
8	1.00	1.00
9	1.00	1.00
10	1.00	1.00
11	1.00	1.00
12	1.00	1.00
13	1.00	1.00

Table 68. Results of cohort analysis for cod in NAFO Div. 2J3KL using fully recruited fishing mortality of 0.21. (Population numbers x 10^{-3}, Population biomass x 10^{-2} tons)

POPULATION NUMBERS

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
4	5405	5771	5081	6371	8160	9250	6674	5733	5342	5863	4729	2029	1133
5	6781	4184	4480	3919	5371	6081	6863	4635	4366	3856	4176	3150	1283
6	3683	1937	2890	3158	2798	3548	4065	3818	2907	2870	2714	2366	1724
7	1928	2472	3009	1832	1993	1717	2029	2016	1738	1542	1500	1209	1400
8	1068	1139	1500	1576	931	1091	905	926	741	710	759	721	671
9	723	610	672	778	683	484	542	398	312	303	363	353	343
10	595	404	368	367	331	342	241	241	160	165	193	191	161
11	394	319	228	195	168	194	135	129	93	96	96	102	87
12	302	224	178	111	98	93	105	61	51	59	61	73	49
13	295	189	147	99	57	59	47	55	12	32	38	35	31
4+	21173	20677	18563	18908	20594	22861	21602	18033	15737	15564	14211	10205	6882
5+	15768	14906	13482	12191	12435	13611	14728	12300	10395	9700	9512	8176	5749
6+	8987	10722	9002	8116	7064	7531	7865	7845	6030	5844	5335	5026	4458
7+	5304	5785	6112	4957	4266	3983	4800	3827	3107	2970	3013	2660	2733

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
4	1084	1904	3383	2820	2731	1467	1556	4029	3885	4752	1696	1779
5	796	701	1251	2160	2031	2124	1092	1021	3001	3058	3736	3707
6	740	423	371	462	1115	1487	1478	774	822	2073	2215	2739
7	750	395	158	191	309	894	946	983	502	501	1348	1509
8	600	240	89	81	89	194	569	577	577	303	297	853
9	329	161	68	42	38	41	115	360	319	339	183	180
10	113	66	33	31	21	19	23	65	187	181	197	116
11	38	31	13	15	16	10	11	12	36	96	110	116
12	19	10	6	6	8	7	6	2	7	21	56	64
13	14	5	3	3	3	5	4	3	4	4	12	31
4+	4382	3909	5358	6113	6910	6248	5800	8002	9343	11336	12370	11095
5+	3298	2005	1995	3191	4179	4782	4246	3973	5458	6571	8173	9315
6+	2502	1241	744	1031	1948	2658	3154	2952	2458	3518	4418	5609
7+	1762	821	370	377	833	1170	1675	2008	1632	1444	2201	2870

Table 68. Continued.

POPULATION BIOMASS (AVERAGE)

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
4	2623	2301	2461	3351	3839	4399	3076	2765	2507	2735	2060	768	649
5	5123	3078	3327	2926	3870	4405	4570	3268	3140	2862	2038	1680	902
6	3736	1800	2053	3113	2722	3340	3394	3231	3836	2599	1812	1766	1299
7	2489	3230	3679	2210	2485	2105	2332	2114	1907	1833	1618	1187	1199
8	1741	1976	2331	2045	1119	1663	1309	1197	1123	1097	1130	910	641
9	1447	1073	1332	1387	1303	920	980	689	609	714	766	538	424
10	1408	979	866	810	820	708	509	495	402	406	471	373	233
11	1132	931	610	529	491	545	351	315	292	294	293	230	140
12	923	759	570	335	320	282	320	126	168	197	193	133	94
13	1371	750	656	417	257	260	197	210	51	140	134	115	71
4+	21985	20479	18690	17344	17591	18627	17298	14431	13946	12678	10533	7706	5653
5+	19372	17679	16229	13993	13706	14229	14222	11666	10339	9943	8174	6938	5003
6+	14249	14598	12902	11067	9836	9824	9652	8398	7198	7081	6435	5256	4102
7+	10513	9798	10047	7953	7114	6484	6258	5167	4542	4682	4593	3490	2803

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
4	575	949	1630	1843	1787	979	1073	2933	3005	3727	3053	3066
5	567	505	899	1031	2073	2067	1081	1203	3311	3136	3513	3267
6	571	356	453	781	1895	2046	1992	1112	1135	3016	2630	3470
7	613	301	268	332	658	1712	1664	1601	899	890	2229	2290
8	580	297	177	185	222	538	1304	1158	1168	644	620	1645
9	290	100	164	123	120	156	335	816	771	775	474	434
10	151	97	89	101	78	82	88	206	478	520	508	330
11	98	51	42	56	64	51	55	53	133	319	315	362
12	69	25	26	29	43	45	33	35	39	100	194	278
13	38	16	14	15	20	31	25	21	25	24	68	138
4+	3523	2778	3763	5296	6961	7769	7603	8113	10968	13414	13863	15240
5+	2947	1829	2132	3453	5174	6791	6530	7210	7964	9422	10810	11775
6+	2380	1323	1234	1422	3102	4725	5450	6007	6830	6287	8297	8508
7+	1809	968	781	640	1207	2679	3458	4895	5695	5271	5667	5038

Table 68. Continued.

"FEMALE MORTALITY"

AGE	1962	1963	19-	1967	19--	1987	1988	19--	1970	197-	1975	1977	197-	197-
4	0.070	0.057	0.060	0.048	0.0-	0.---	0.---	0.07-	0.---	0.---	0.---	0.---	0.---	0.---
5	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
6	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
7	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
8	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
9	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
10	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
11	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
12	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
13	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---

AGE	197-	1977	1978	1979	1980	1981	1982	1983	198-	1985	1986
4	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
5	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
6	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
7	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
8	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
9	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
10	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
11	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
12	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---
13	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---	0.---

Table 69. Parameters used as imput for catch projections of NAFO Division 2J3KL cod.

Age	Beginning year 1987 population abundance (millions)	Average weights (1984-86 ave.) (kg)	Partial recruitment
4	300	0.78	0.17
5	378	1.11	0.67
6	264	1.59	0.97
7	183	2.06	1.00
8	100	2.57	1.00
9	57	3.04	1.00
10	12	3.48	1.00
11	8	4.05	1.00
12	8	5.09	1.00
13	4	6.92	1.00

Table 70. Results of stock and catch projections for cod in NAFO Div. 2J3KL showing A) population numbers, B) population biomass, C) catch biomass and D) fishing mortality.

Population numbers (millions)

A	1986	1987	1988
4	478	300	265
5	371	378	238
6	274	264	274
7	151	183	181
8	85	100	125
9	18	57	68
10	12	12	39
11	12	8	8
12	6	8	5
13	3	4	5
4+	1409	1312	1208
5+	931	1012	943
6+	561	635	705
7+	287	371	431

Population biomass (000't)

B	1986	1987	1988
4	332	209	184
5	349	358	225
6	358	349	359
7	255	313	307
8	180	214	264
9	45	143	171
10	33	35	111
11	39	26	27
12	27	33	22
13	17	24	30
4+	1635	1704	1701
5+	1303	1495	1516
6+	954	1137	1292
7+	595	787	932

Catch biomass (000't)

C	1986	1987	1988
4	12	6	6
5	49	44	30
6	73	62	70
7	54	57	41
8	36	39	53
9	9	26	34
10	7	6	22
11	8	5	5
12	6	6	4
13	4	4	6
4+	259	256	293
5+	248	250	286
6+	199	206	256
7+	126	144	186

Fishing Mortality

D	1986	1987	1988
4	0.036	0.031	0.034
5	0.141	0.122	0.134
6	0.204	0.177	0.194
7	0.210	0.183	0.200
8	0.210	0.183	0.200
9	0.210	0.183	0.200
10	0.210	0.183	0.200
11	0.210	0.183	0.200
12	0.209	0.183	0.200
13	0.239	0.183	0.200
4+	0.132	0.130	0.149

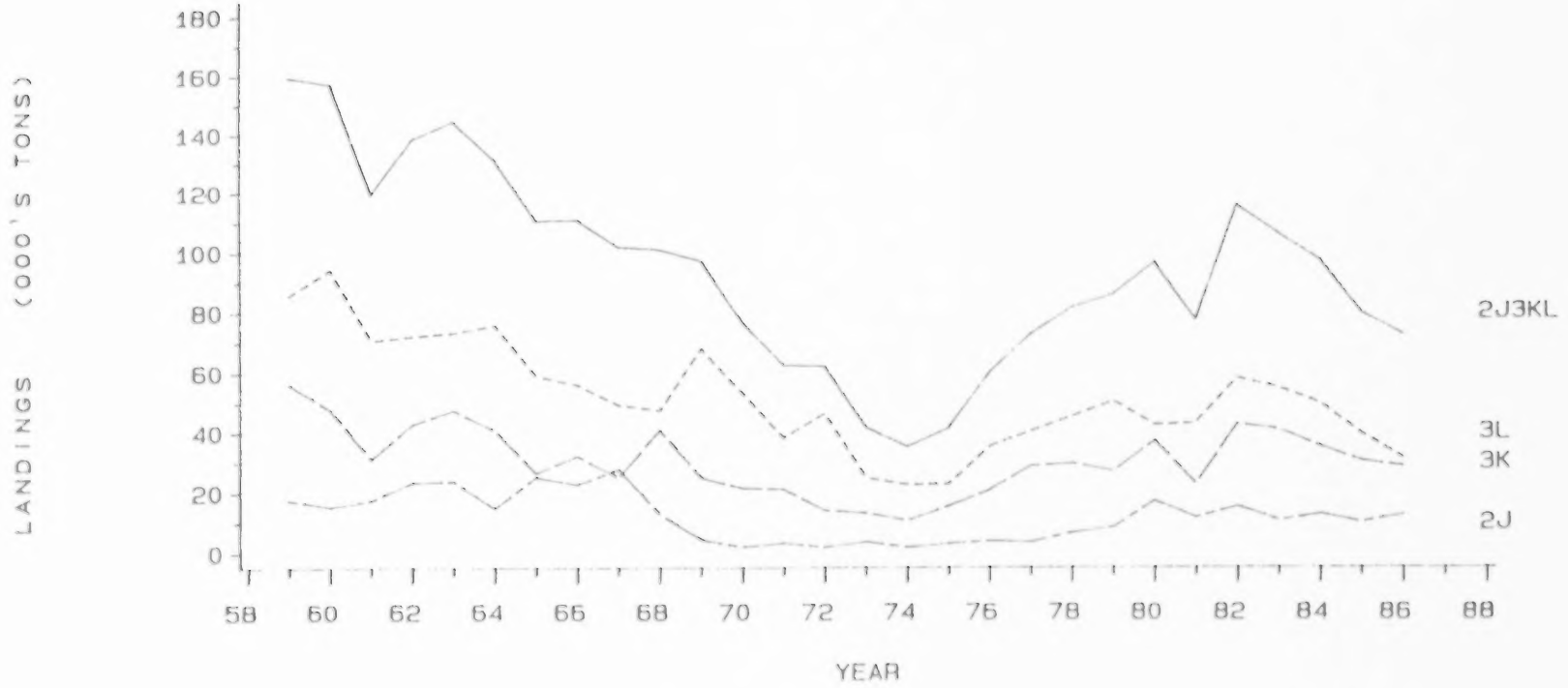

FIG. 1. INSHORE COD CATCHES FROM DIVISIONS 2J3KL FOR THE YEARS 1959-1986.

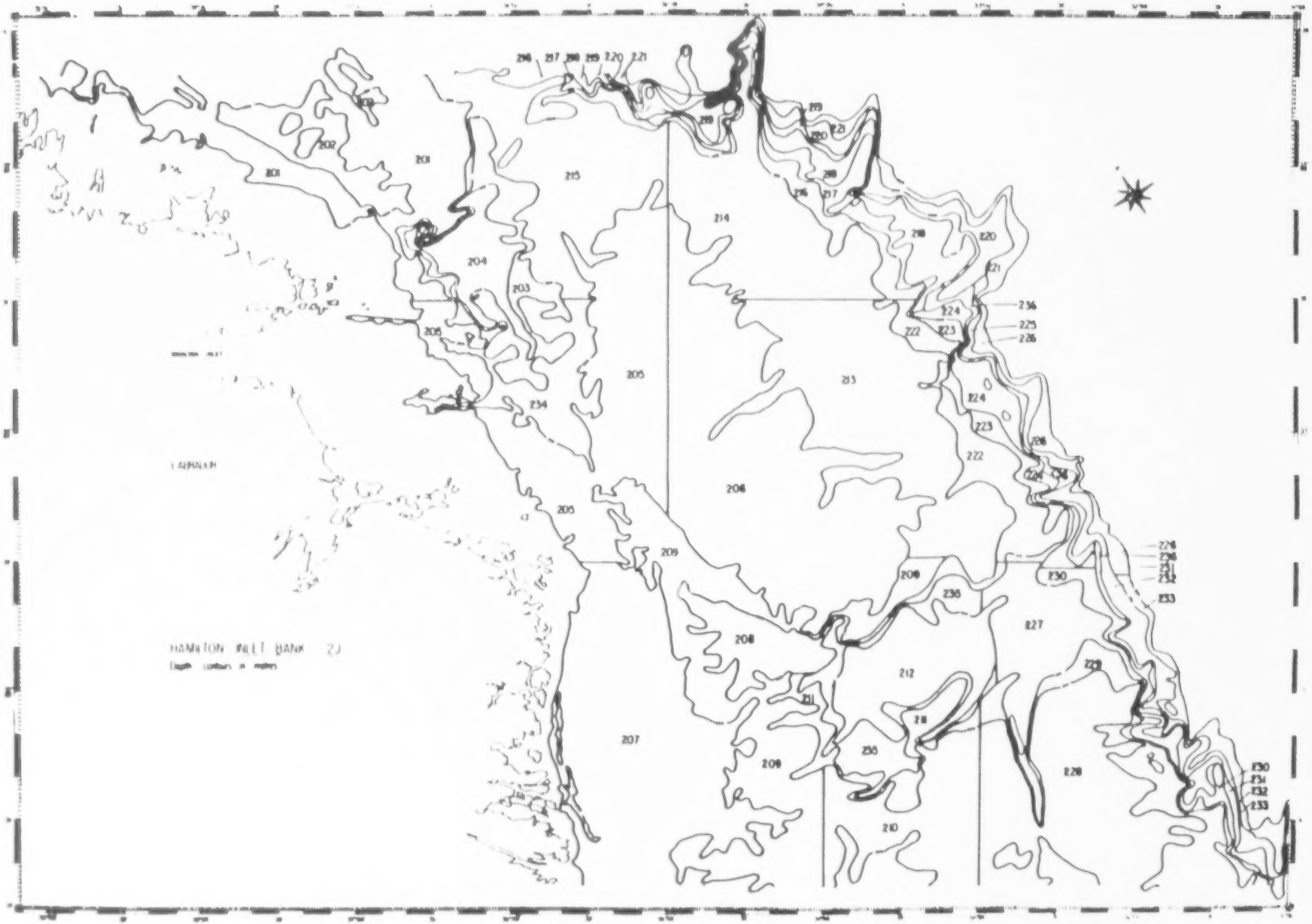

Fig. 2. Area of stratification in NAFO Division 2J used for research vessel surveys.

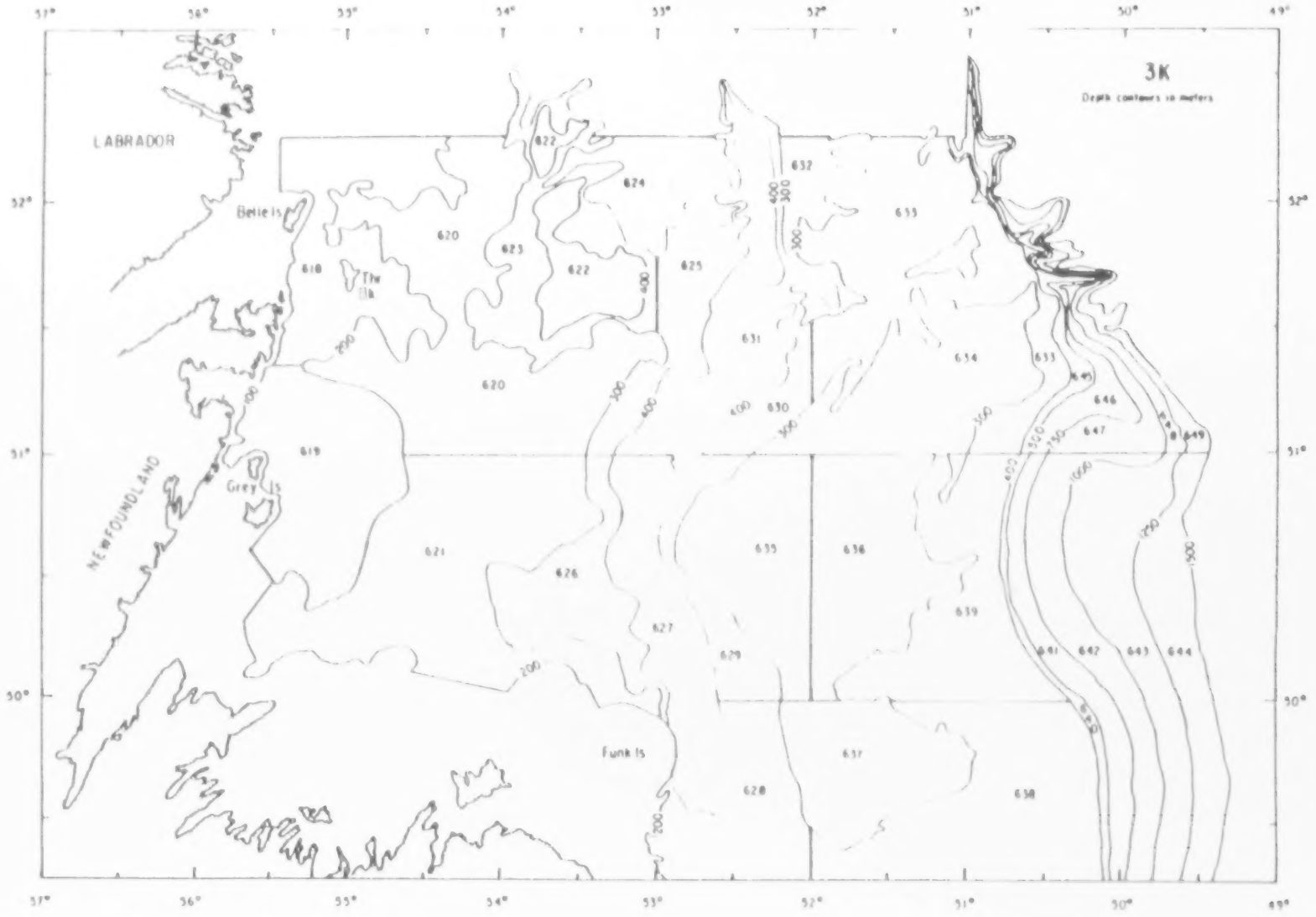

Fig. 3. Area of stratification in NAFO Division 3K used for research vessel surveys.

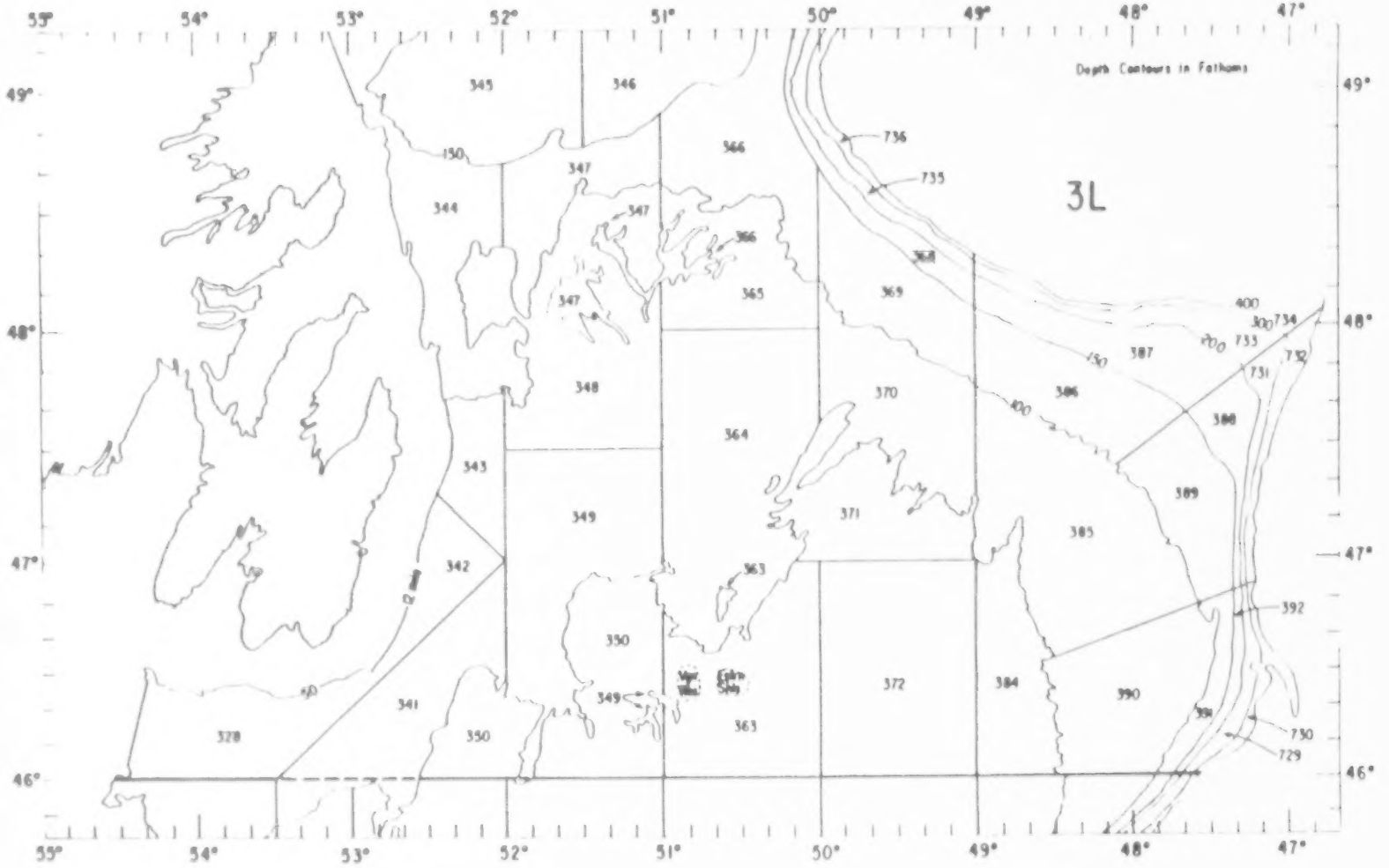

Fig. 4. Area of stratification in NAFO Division 3L used for research vessel surveys.

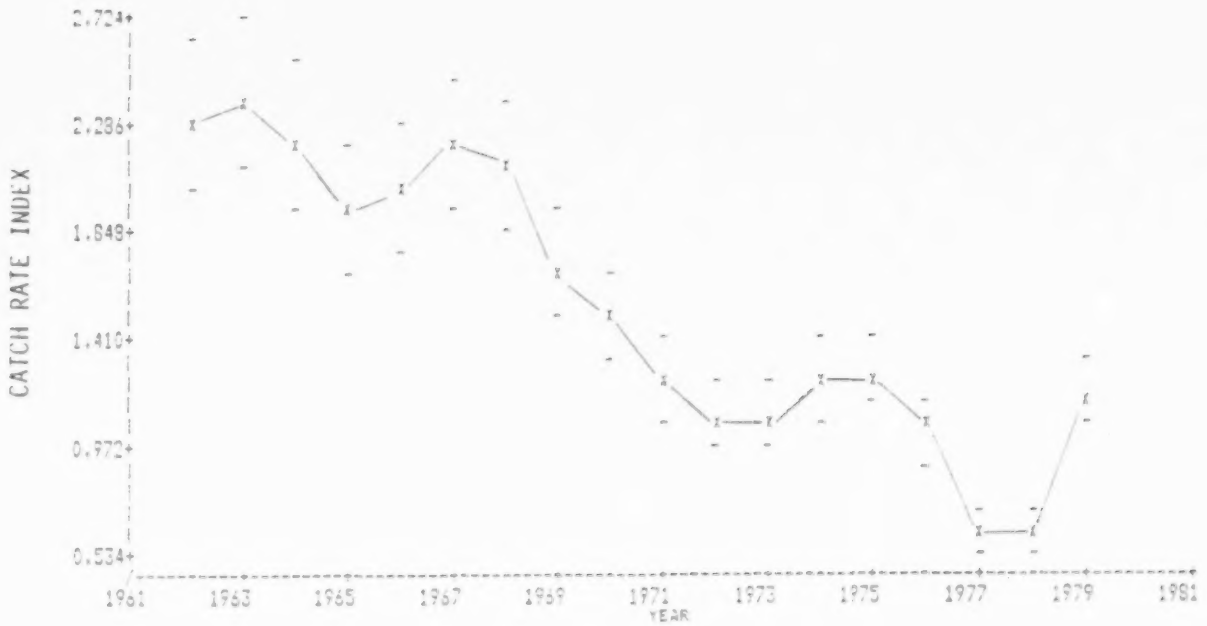

Fig. 5a. Commercial catch rate index for cod in Divisions 2J3KL for the period 1962-79.

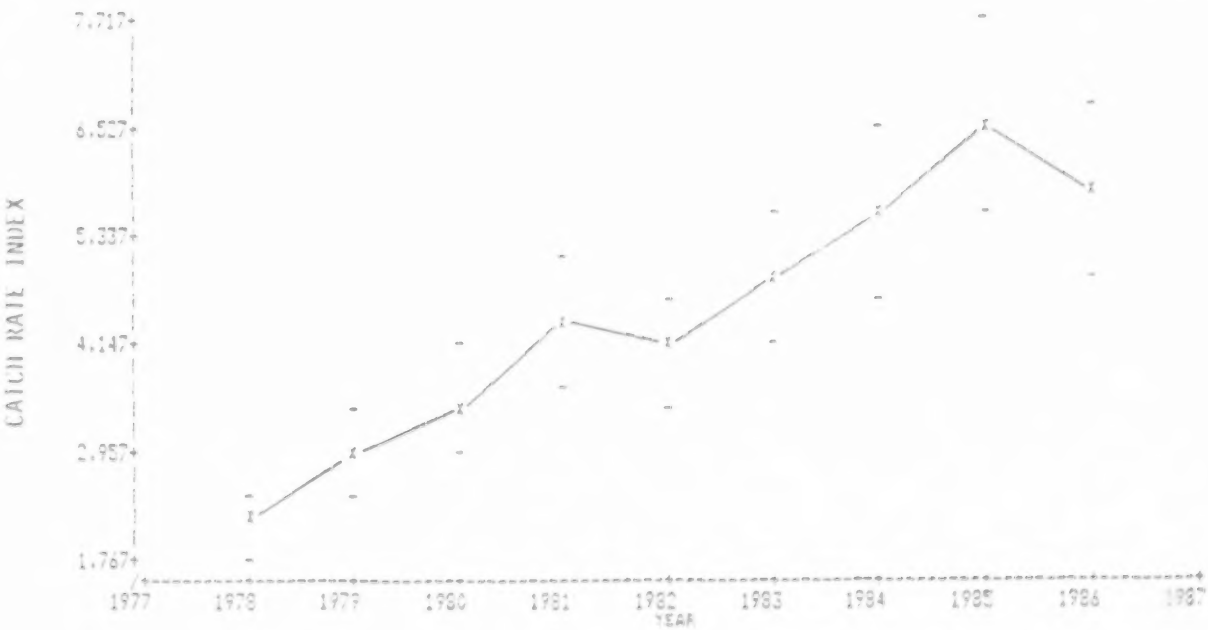

Fig. 5b. Commercial catch rate index for cod in Divisions 2J3KL for the period 1978-86.

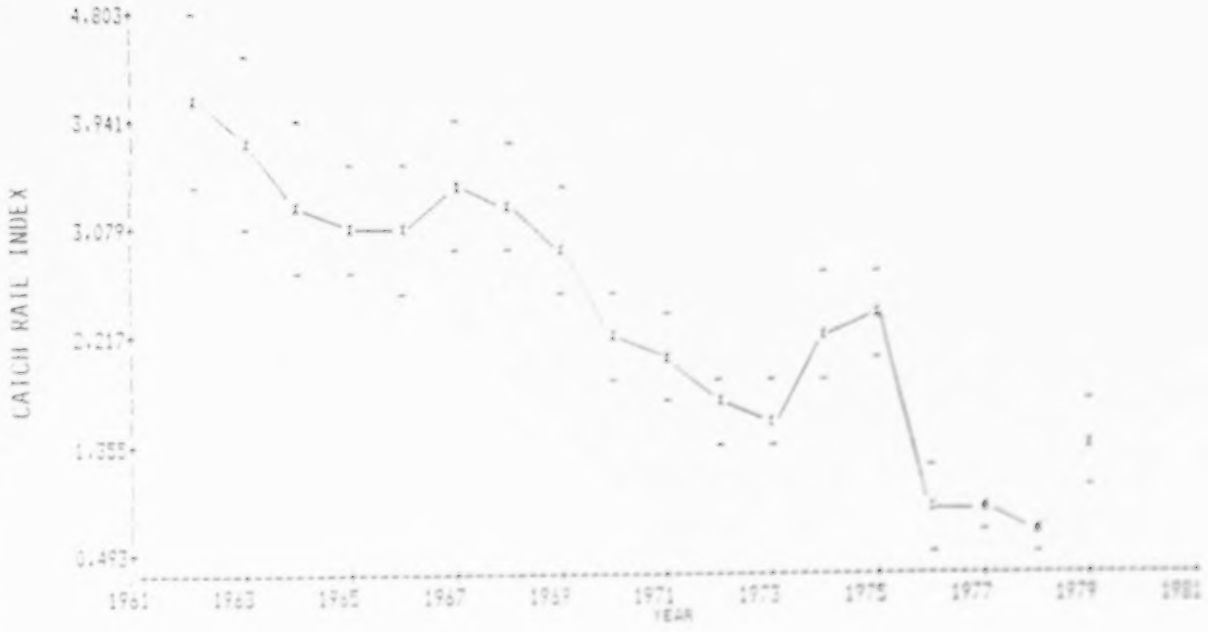

Fig. 6a. Commercial catch rate index for cod in Division 2J for the period 1962-79.

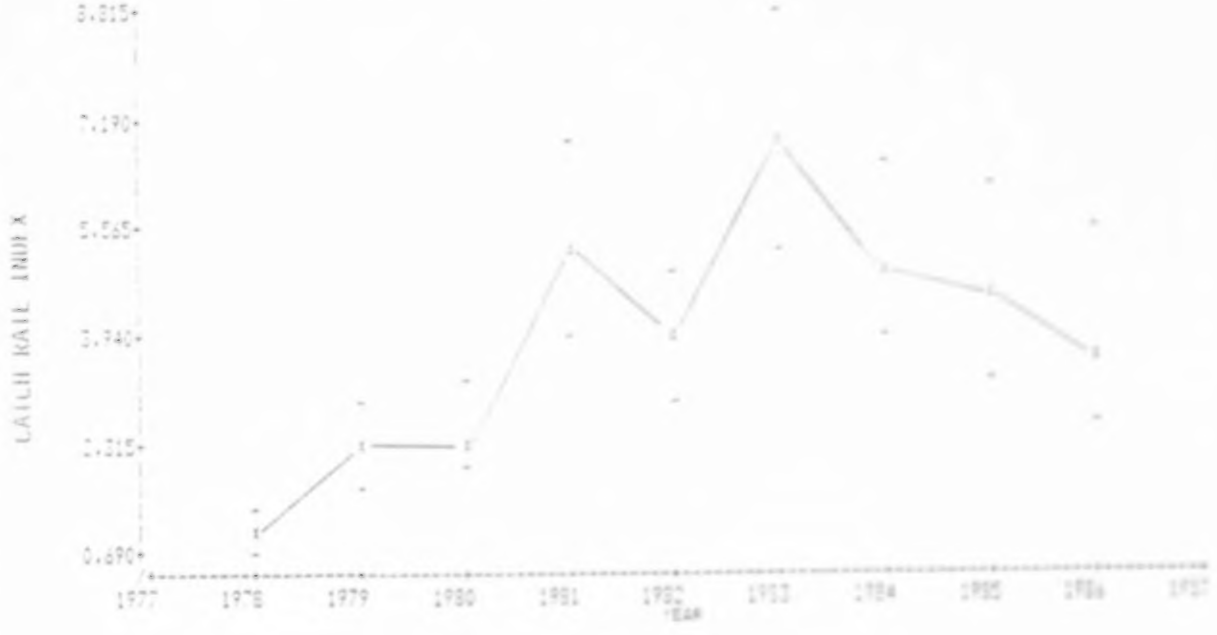

Fig. 6b. Commercial catch rate index for cod in Division 2J for the period 1978-86.

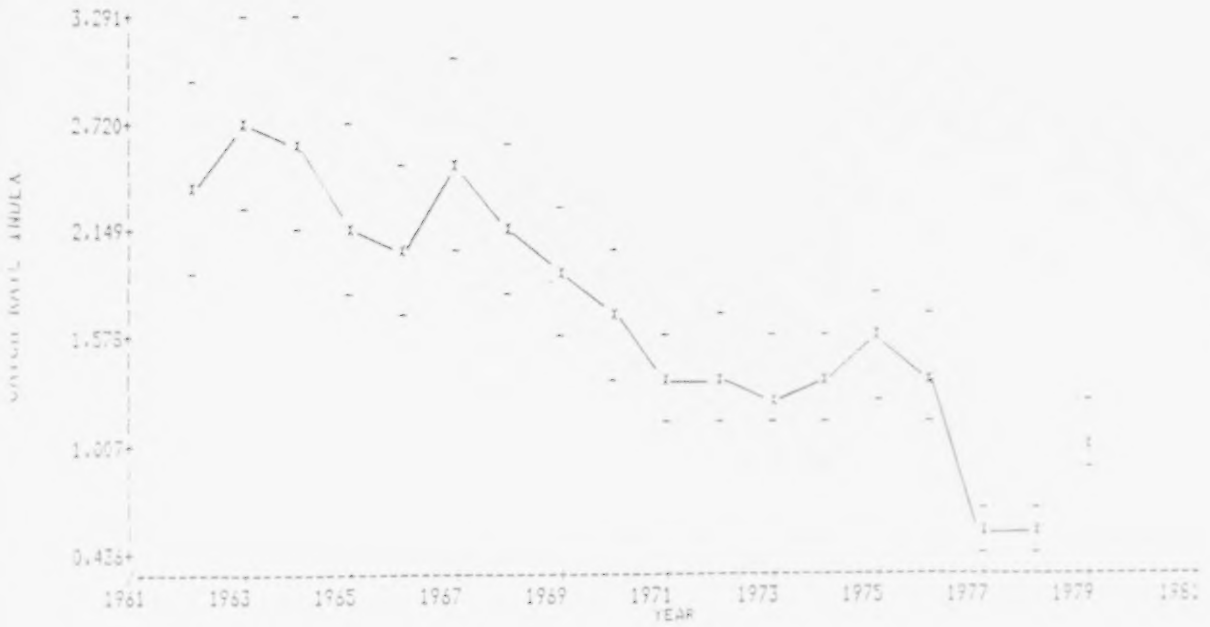

Fig. 7a. Commercial catch rate index for cod in Division 3K for the period 1962-79.

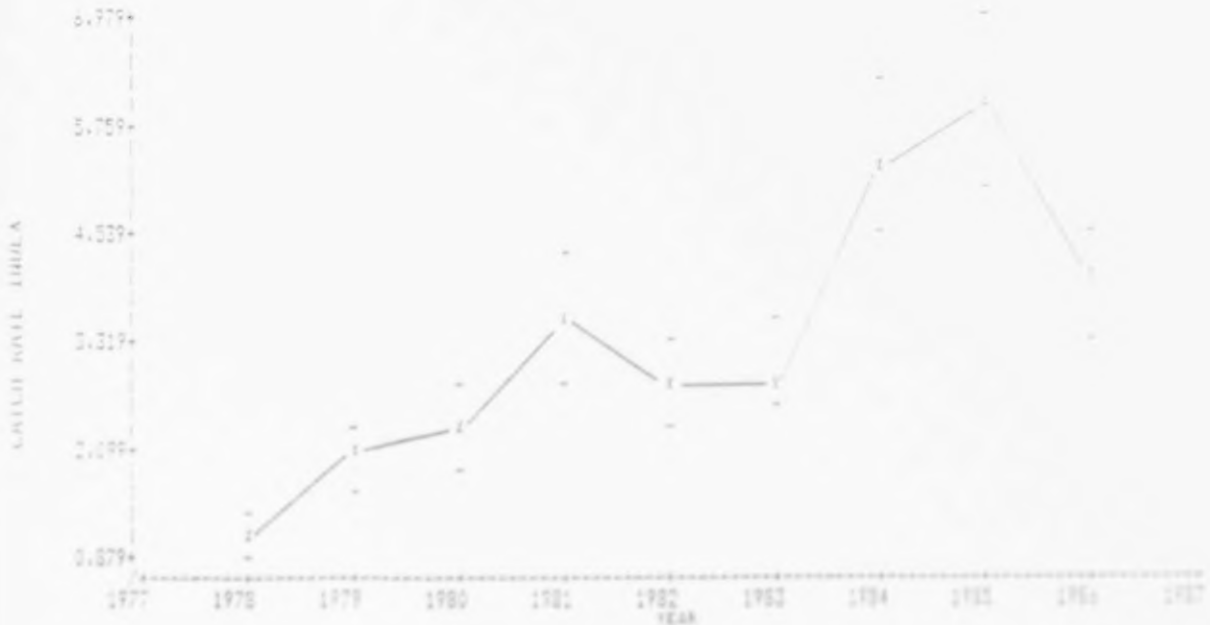

Fig. 7b. Commercial catch rate index for cod in Division 3K for the period 1978-86.

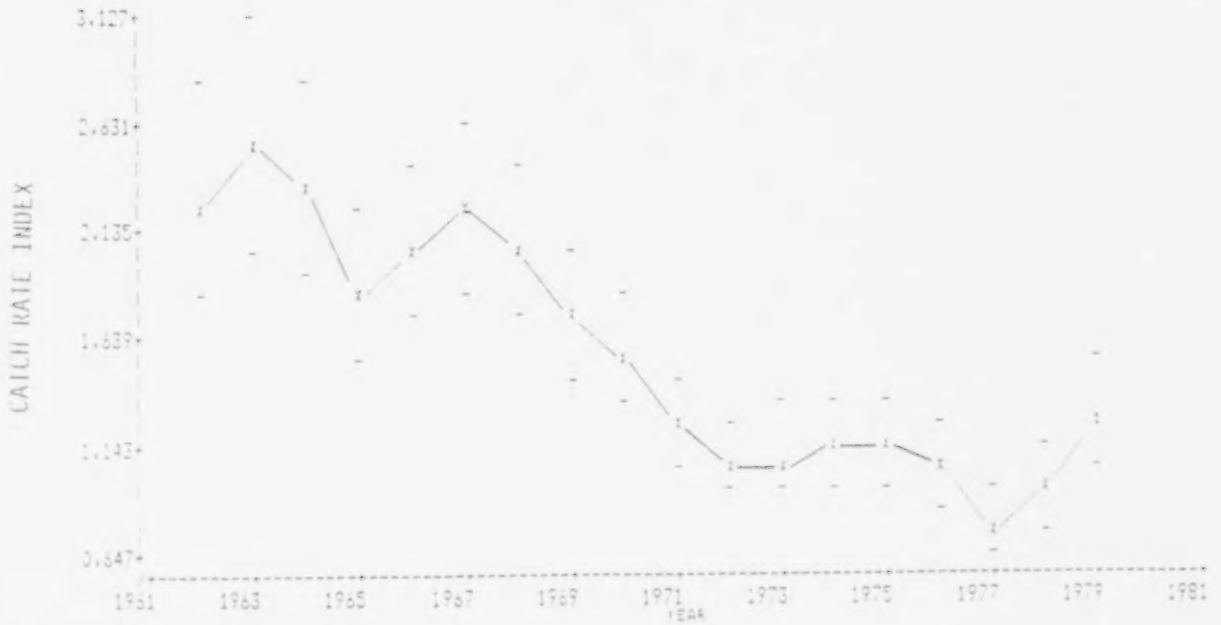

Fig. 8a. Commercial catch rate index for cod in Division 3L for the period 1962-79.

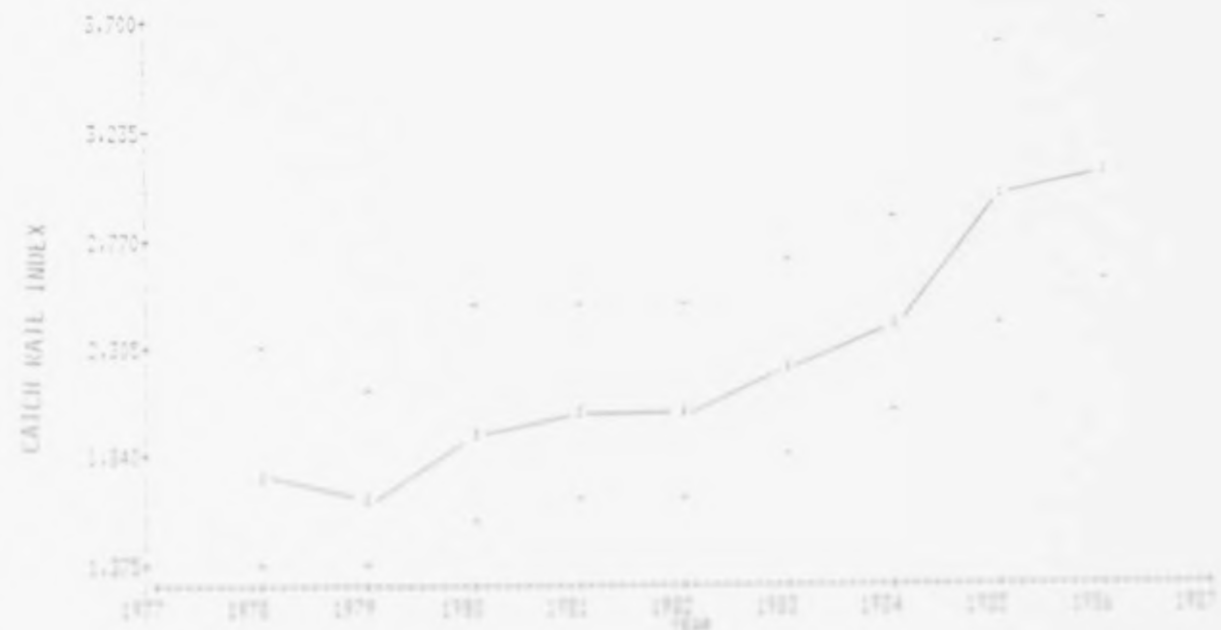

Fig. 8b. Commercial catch rate index for cod in Division 3L for the period 1979-86.

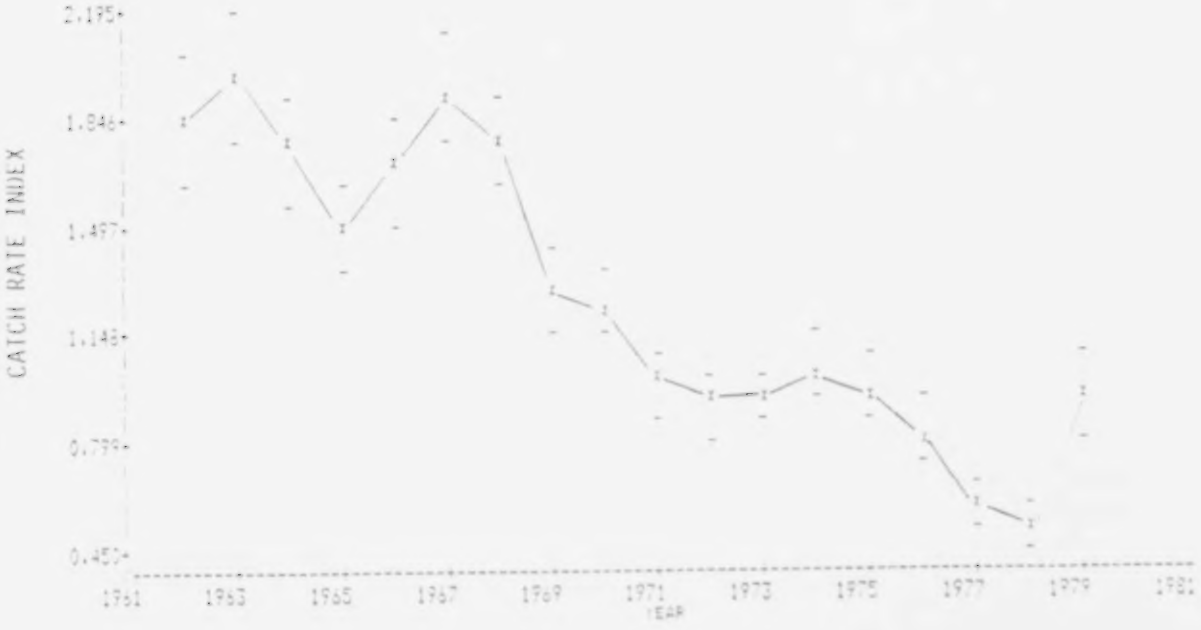

Fig. 9a. Commercial catch rate index for cod in Divisions 2J3KL for the period 1962-79 (analysis conducted excluding data from the first quarter).

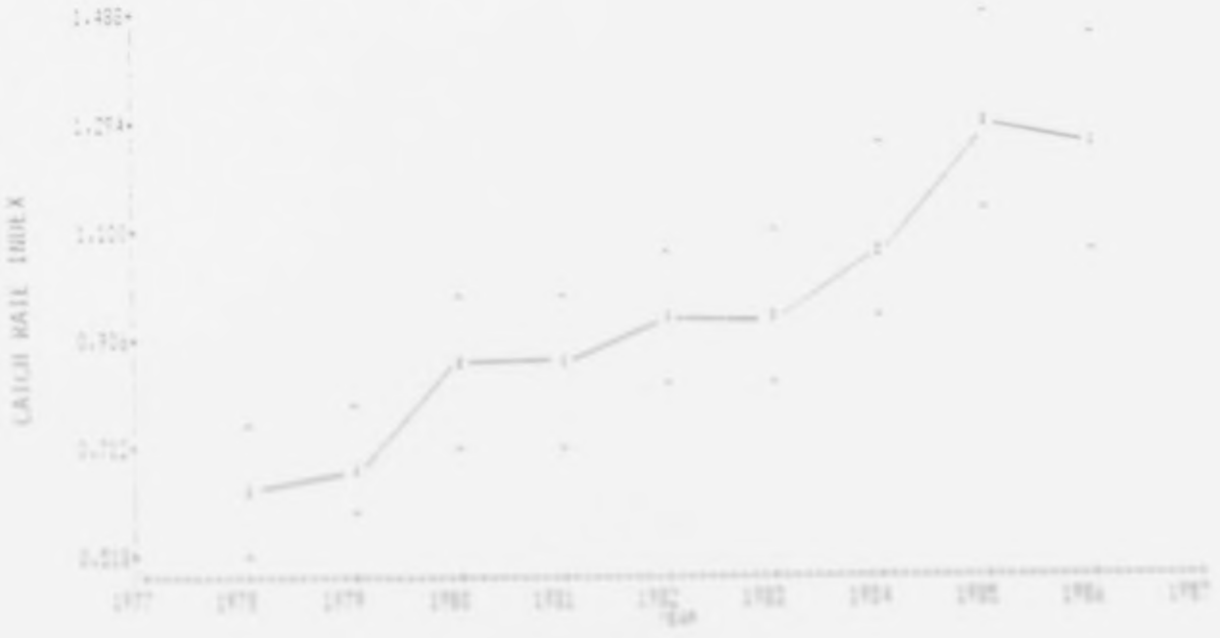

Fig. 9b. Commercial catch rate index for cod in Divisions 2J3KL for the period 1978-86 (analysis conducted excluding data from the first quarter).

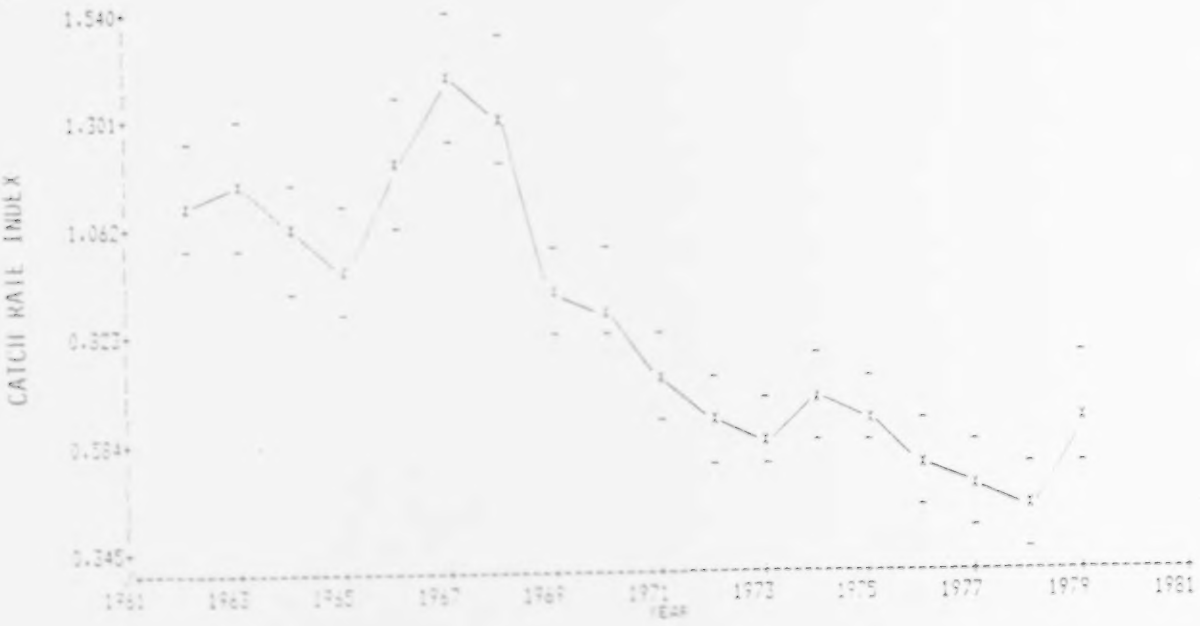

Fig. 10a. Commercial catch rate index for cod in Divisions 2J3KL for the period 1962-79 (analysis conducted excluding data from the first and second quarters).

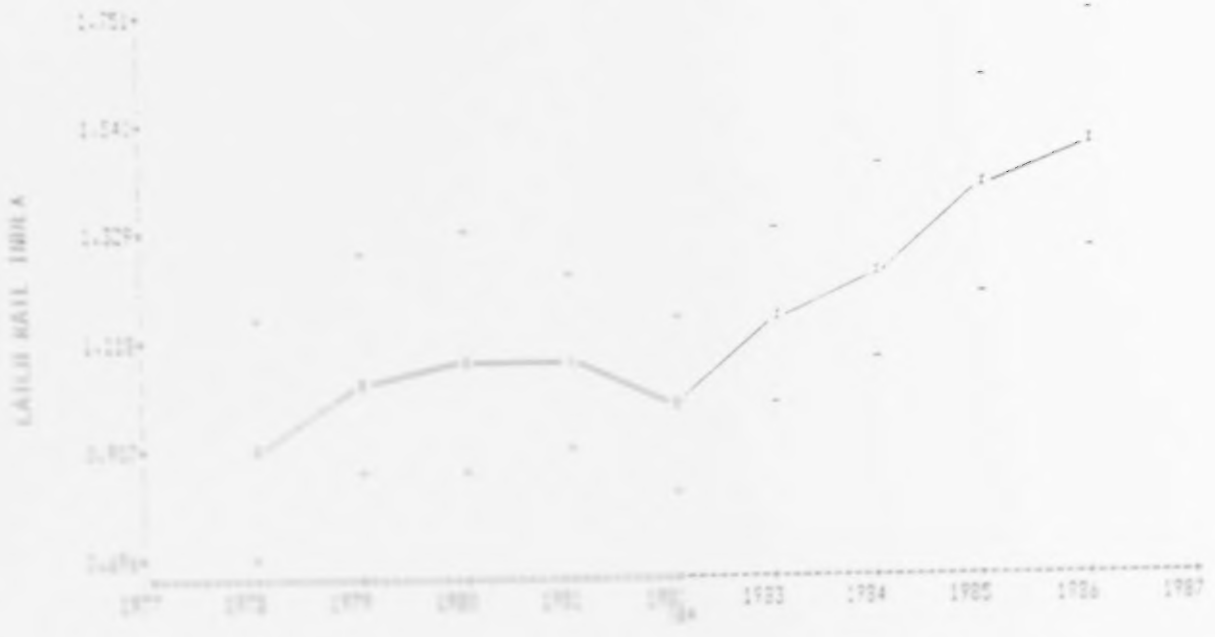

Fig. 10b. Commercial catch rate index for cod in Divisions 2J3KL for the period 1978-88 (analysis conducted excluding data from the first and second quarters).

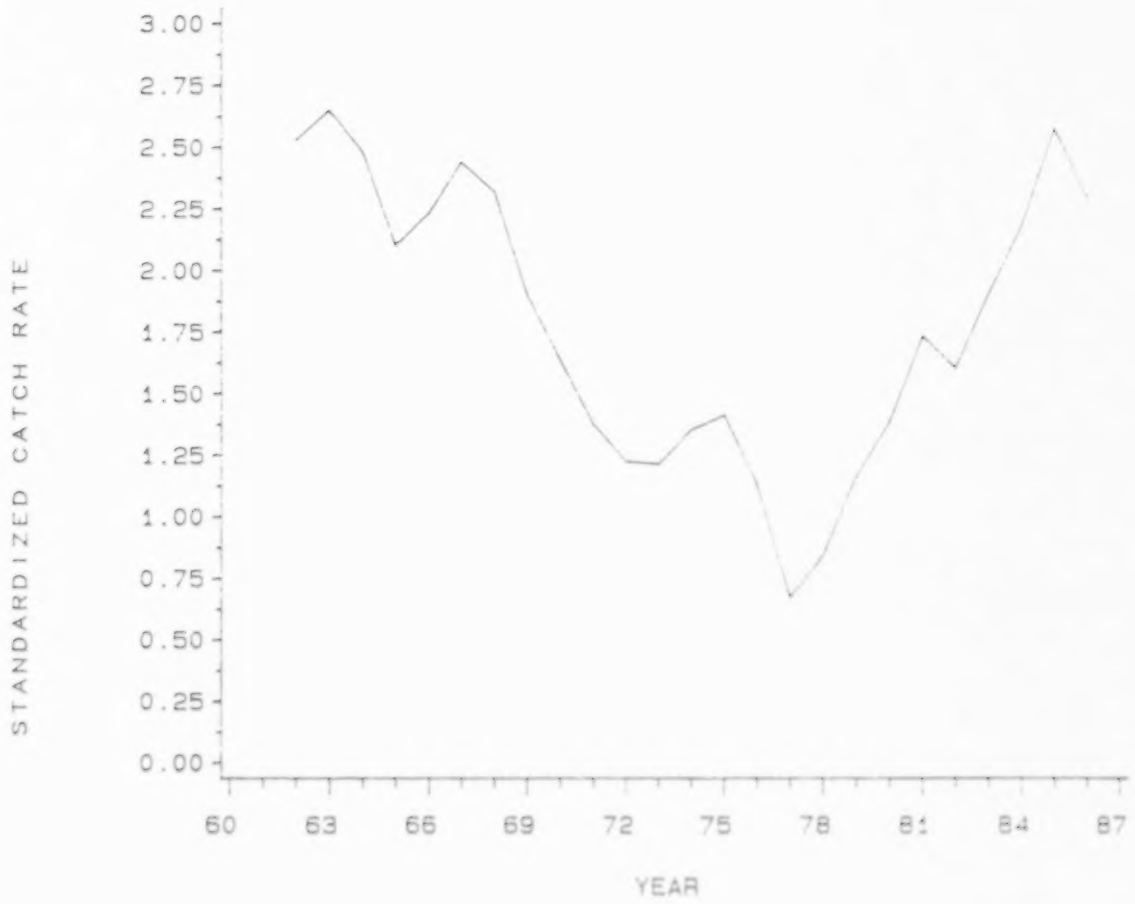

FIG. 11. STANDARDIZED CATCH RATE FOR COD IN NAFO DIV 2J3KL FOR THE PERIOD 1962-86.

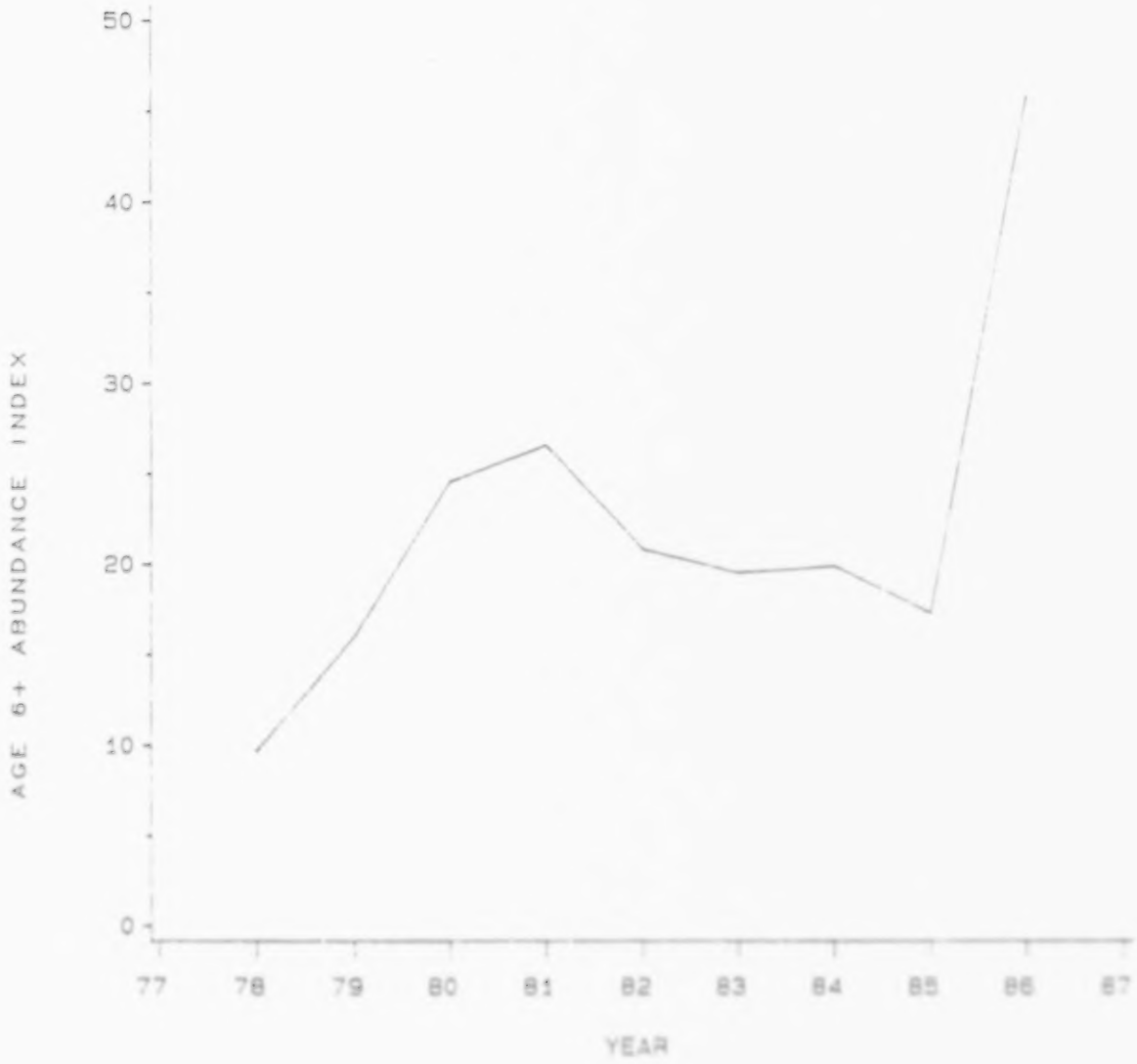

FIG. 12. AGE 6+ ABUNDANCE INDEX FOR COD IN DIV 3JKL FOR THE PERIOD 1978-86 DERIVED FROM FALL R/V SURVEYS.

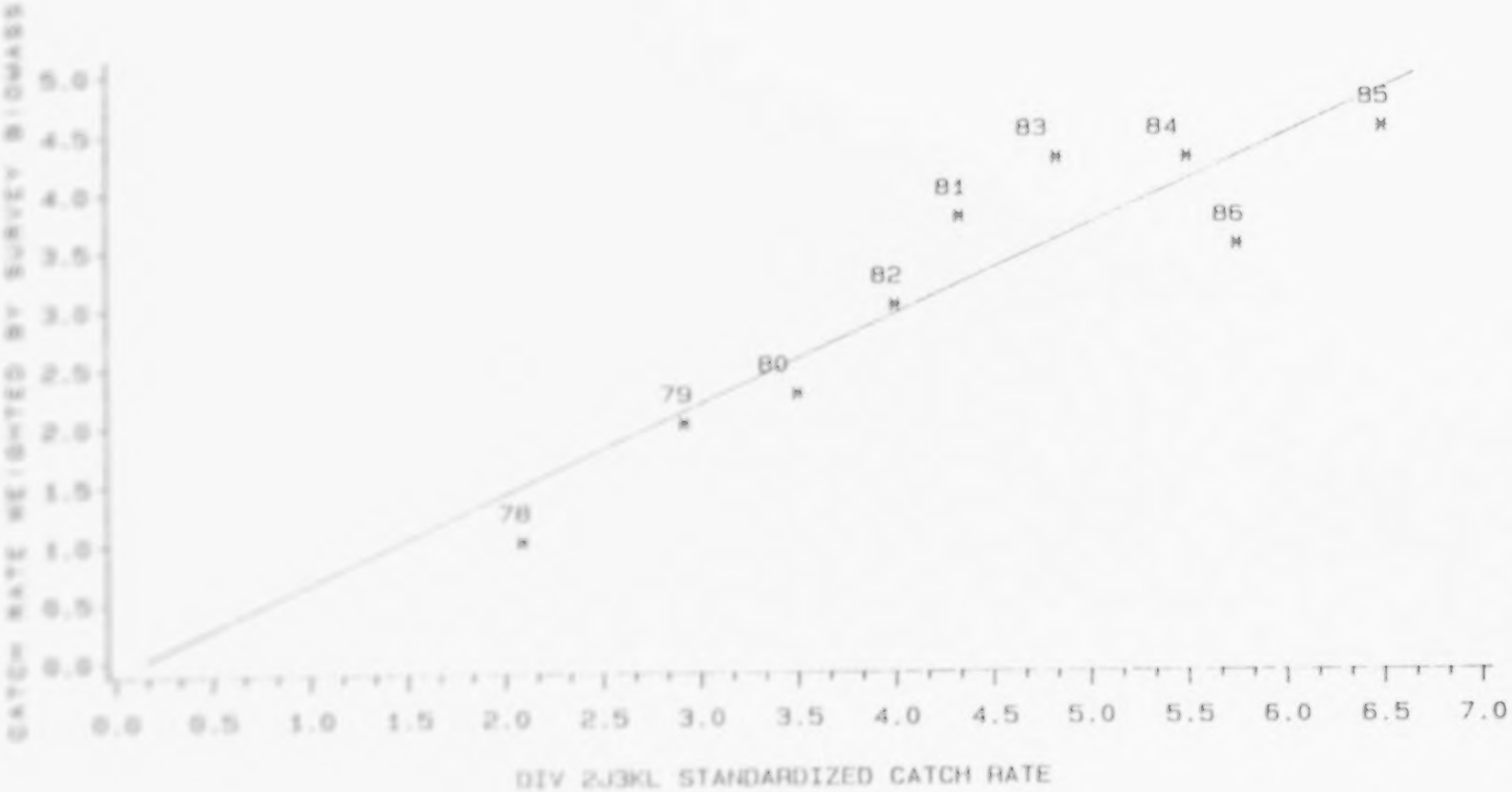

FIG #3. RELATIONSHIP OF CATCH RATE WEIGHTED BY SURVEY BIOMASS WITH STANDARDIZED CATCH RATE FOR THE FOR THE PERIOD 1978-86.

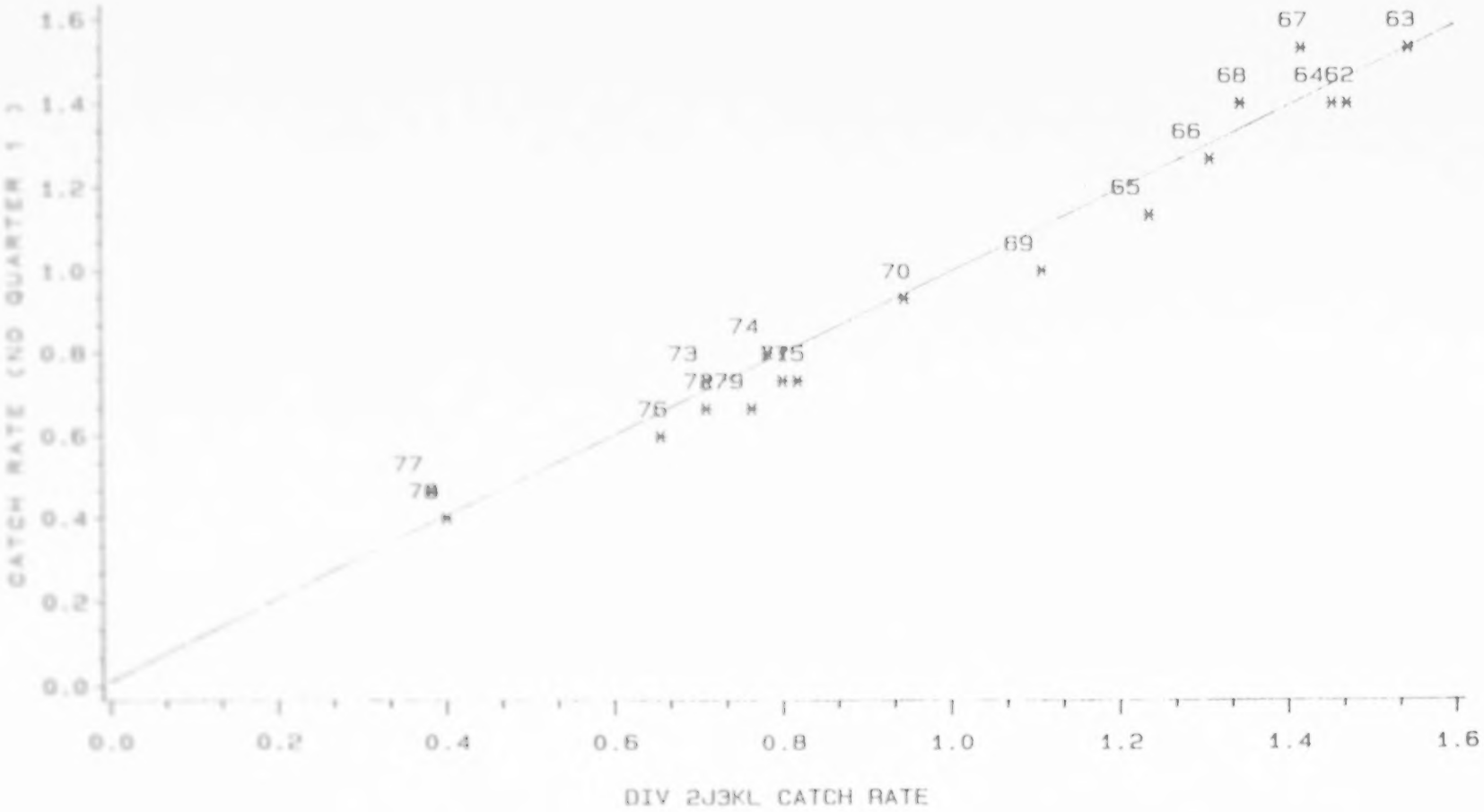

FIG 14 . RELATIONSHIP OF STANDARDIZED CATCH RATE EXCLUDING FIRST QUARTER DATA WITH STANDARDIZED CATCH RATE FOR THE ENTIRE YEAR FOR THE PERIOD 1962-79.

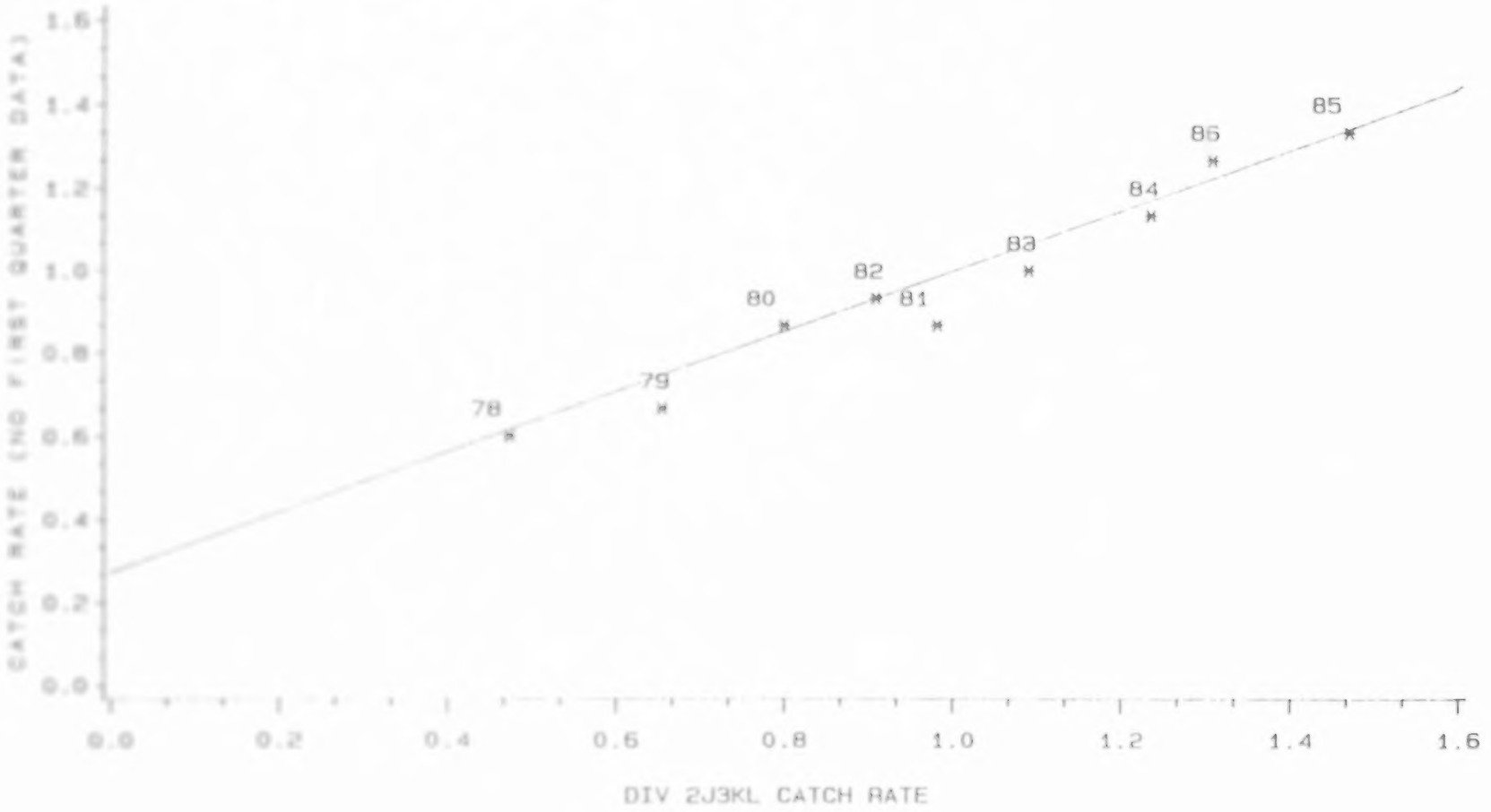

FIG 15. RELATIONSHIP OF STANDARDIZED CATCH RATE EXCLUDING FIRST QUARTER DATA WITH STANDARDIZED CATCH RATE FOR THE ENTIRE YEAR FOR THE PERIOD 1978-86

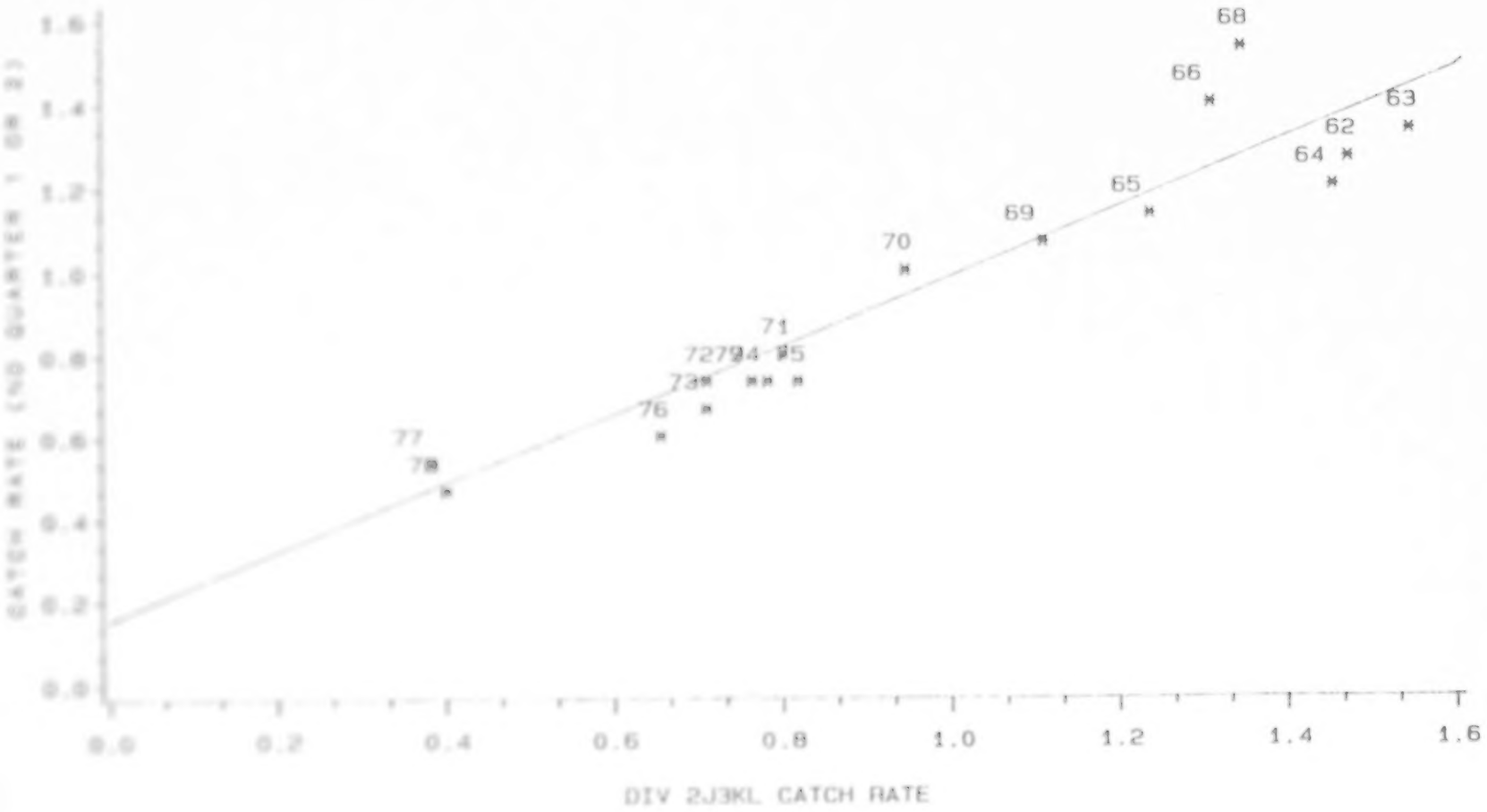

FIG 4. RELATIONSHIP OF STANDARDIZED CATCH RATE EXCLUDING FIRST AND SECOND QUARTER DATA WITH STANDARDIZED CATCH RATE FOR THE ENTIRE YEAR FOR THE PERIOD 1962-79.

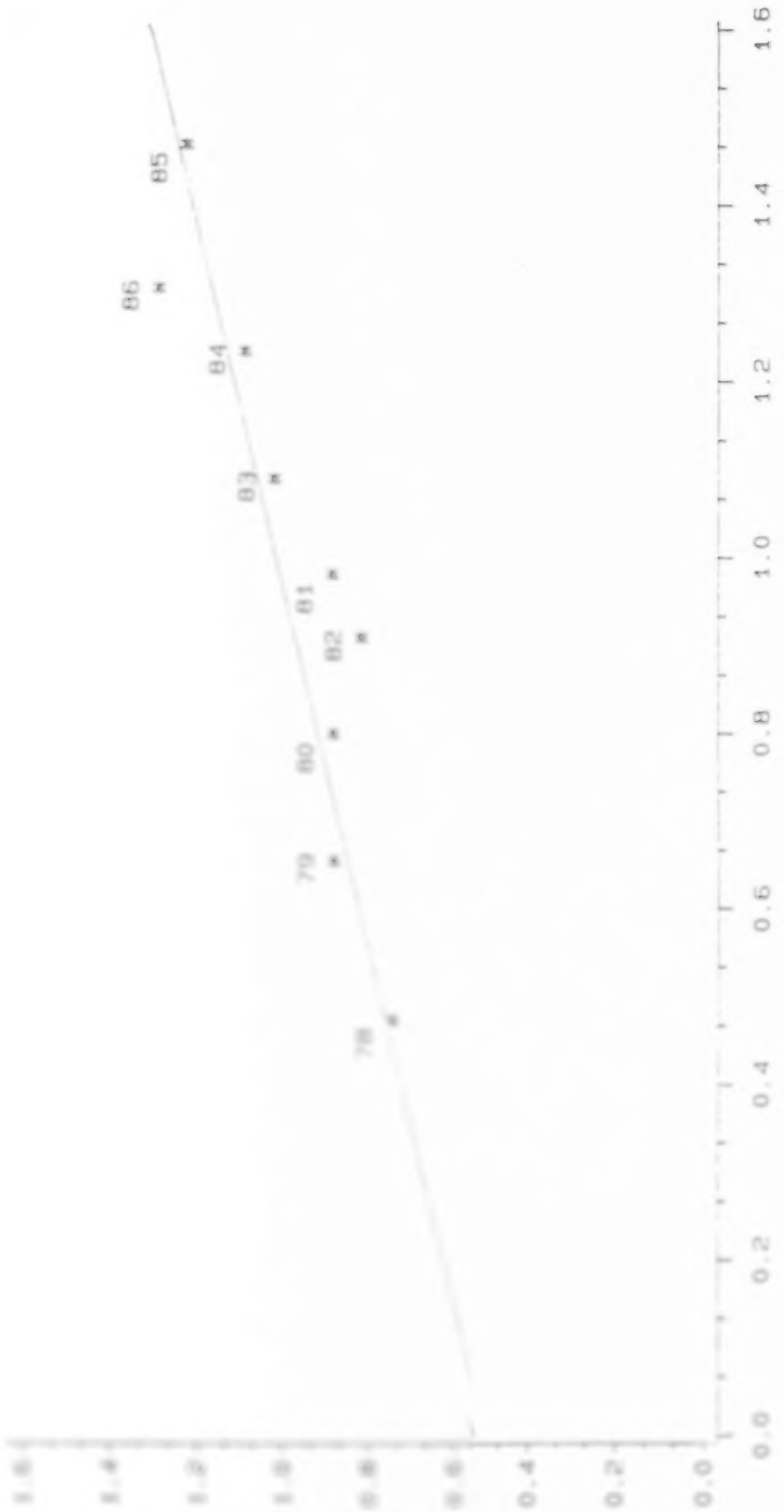

FIG 17 . RELATIONSHIP OF STANDARDIZED CATCH RATE EXCLUDING FIRST AND SECOND QUARTER DATA WITH STANDARDIZED CATCH RATE FOR THE ENTIRE YEAR FOR THE PERIOD 1978-86.

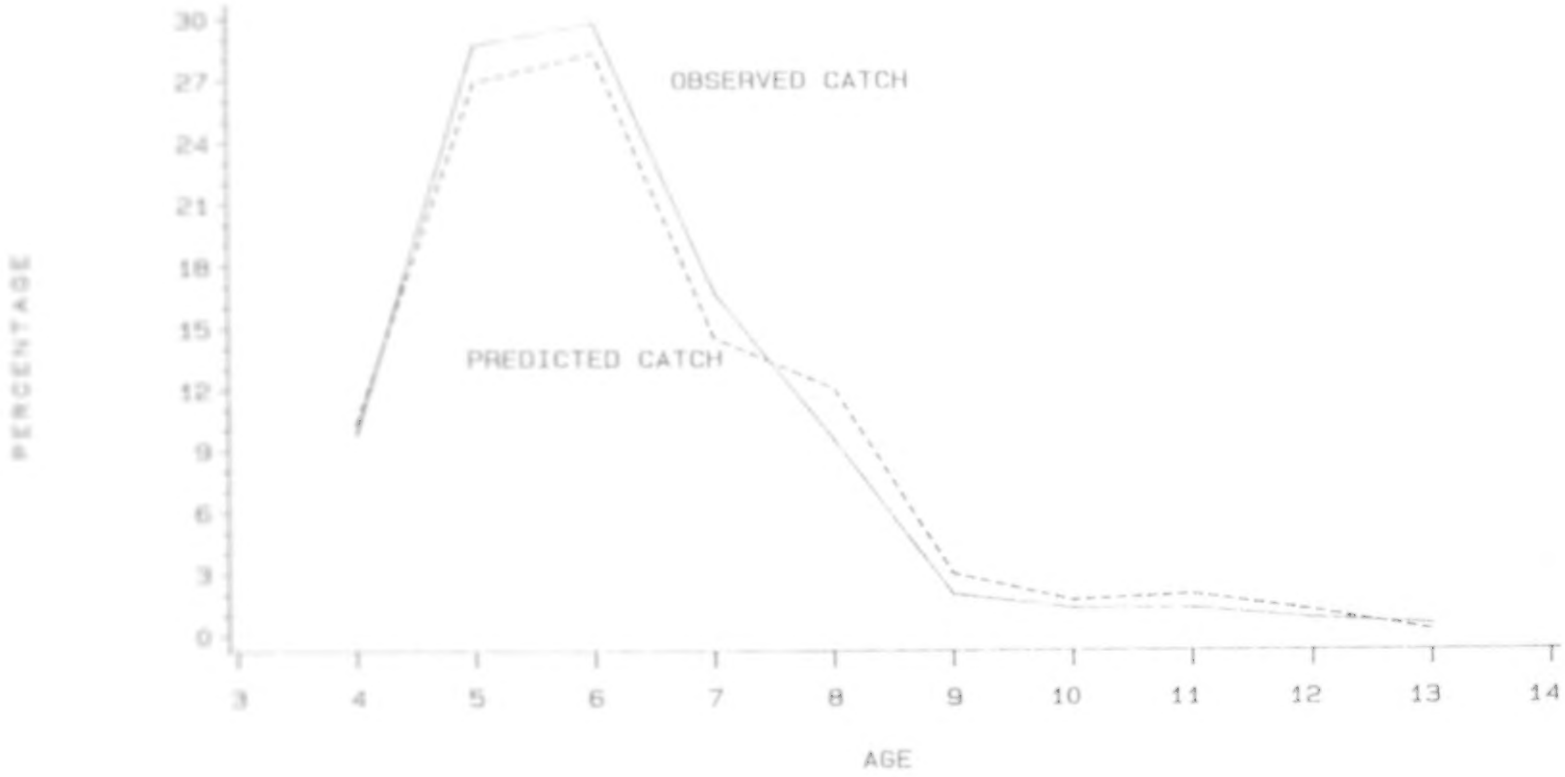

FIG. 18. COMPARISON OF THE 1986 OBSERVED AND PREDICTED CATCH AT AGE FOR THE COD FISHERY IN NAFO DIV 2J3KL.

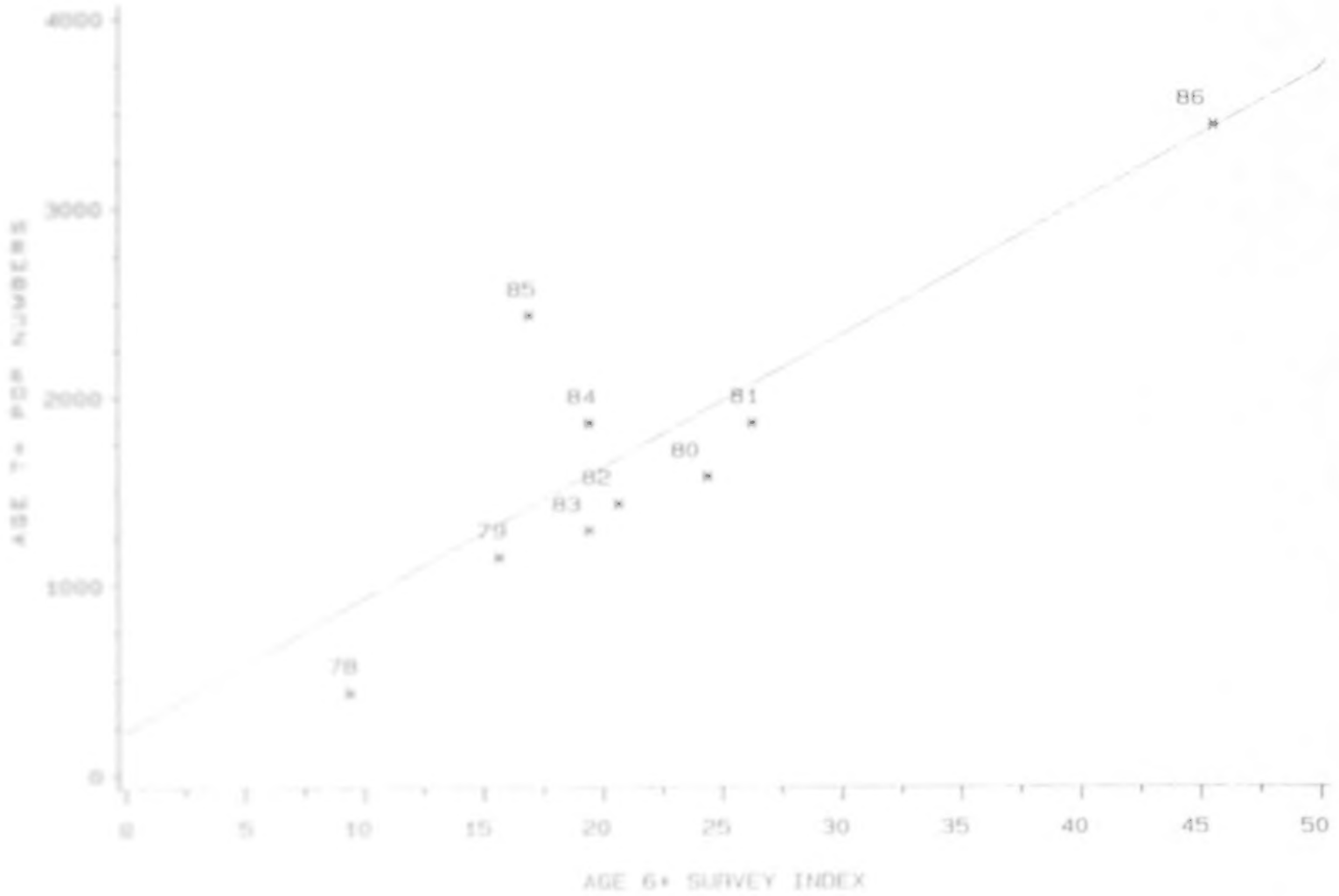

FIG 19. RELATIONSHIP OF AGE 6+ SURVEY INDEX WITH AGE 7+ POP. NUMBERS AT THE BEGINNING OF THE FOLLOWING YEAR FOR DIV 2J3KL COD WITH F-86 = 0.25 (1978-86).

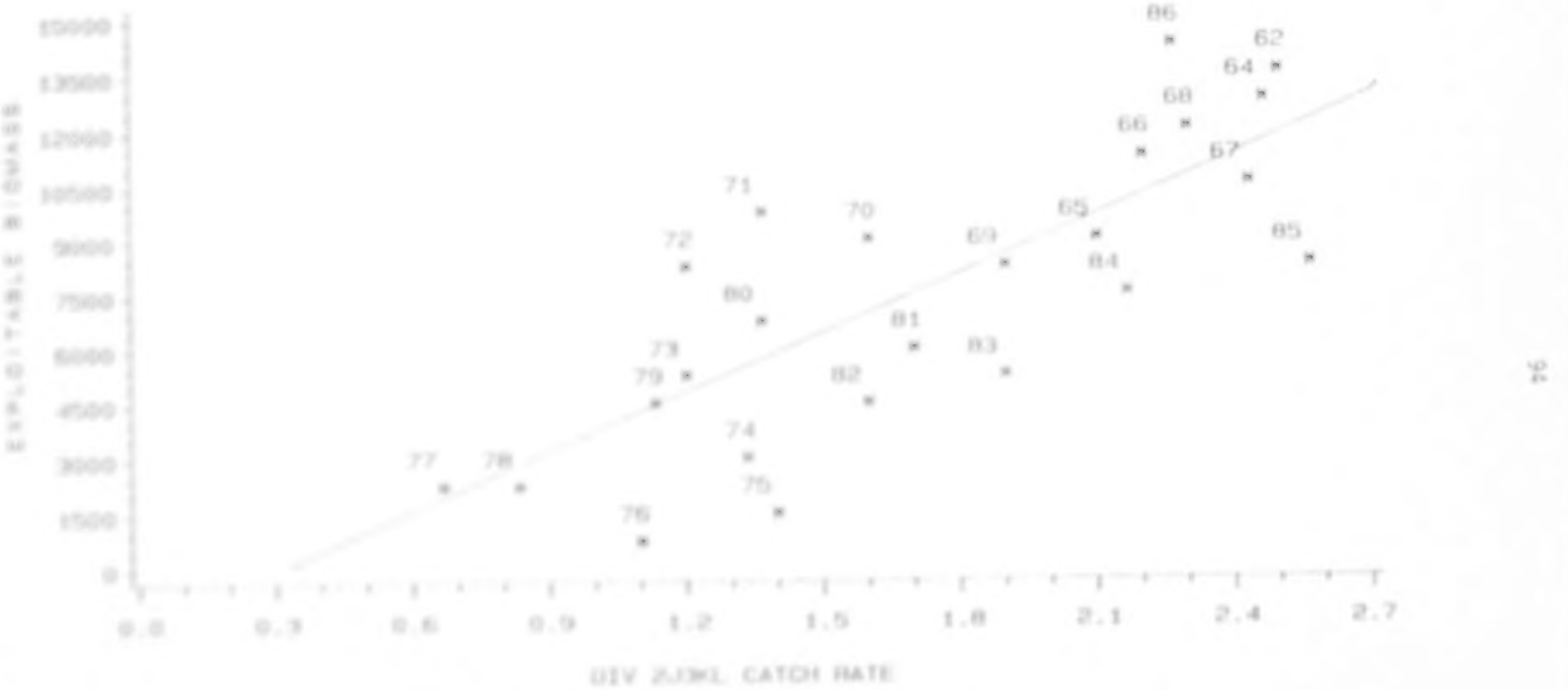

FIG 20. RELATIONSHIP OF STANDARDIZED CATCH RATE WITH COHORT EXPLOITABLE BIOMASS FOR DIV 2J3KL COD USING TERMINAL FISHING MORTALITY = 0.15 (1962-86).

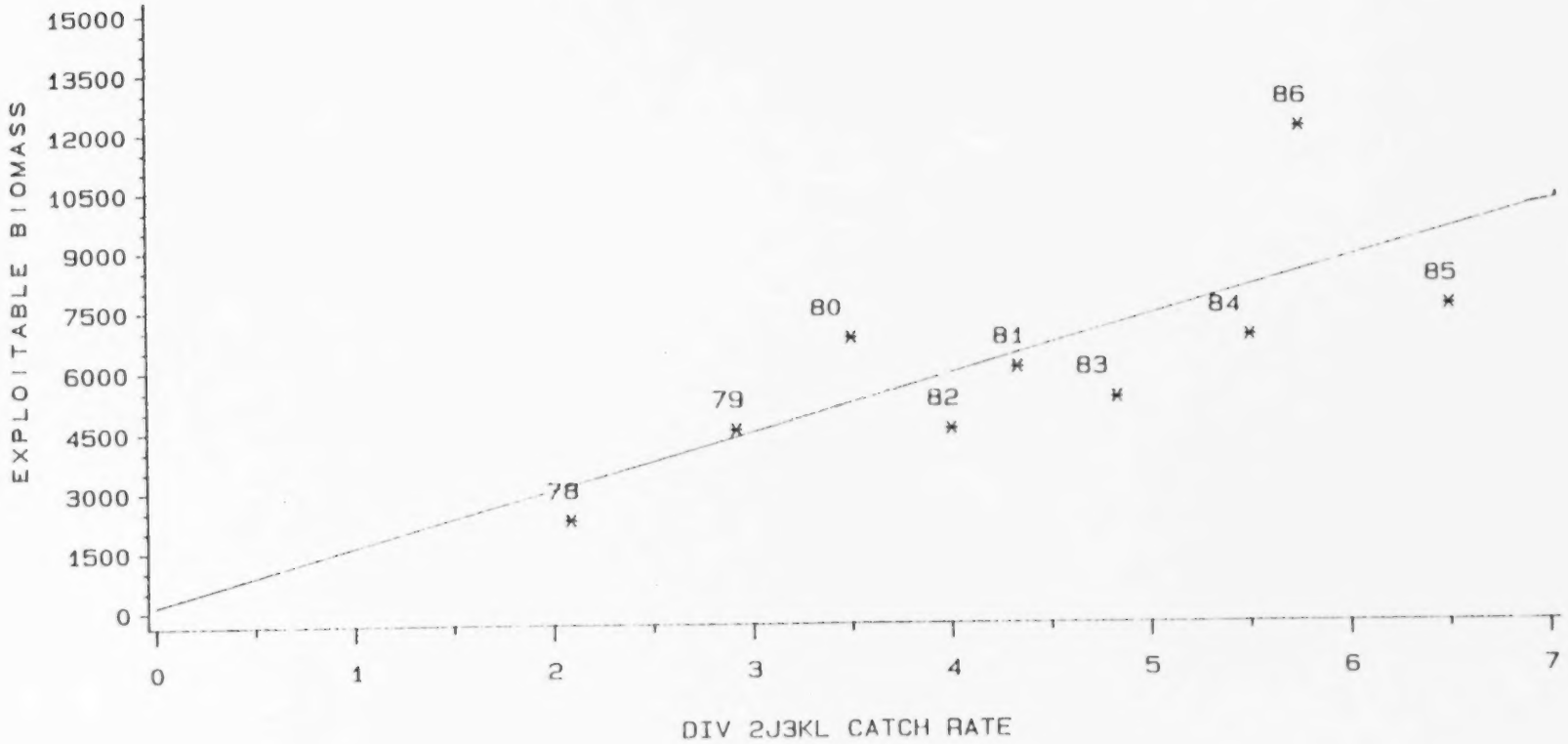

FIG 21. RELATIONSHIP OF STANDARDIZED CATCH RATE WITH COHORT EXPLOITABLE BIOMASS FOR DIV 2J3KL COD USING TERMINAL FISHING MORTALITY = 0.17 (1978-86).

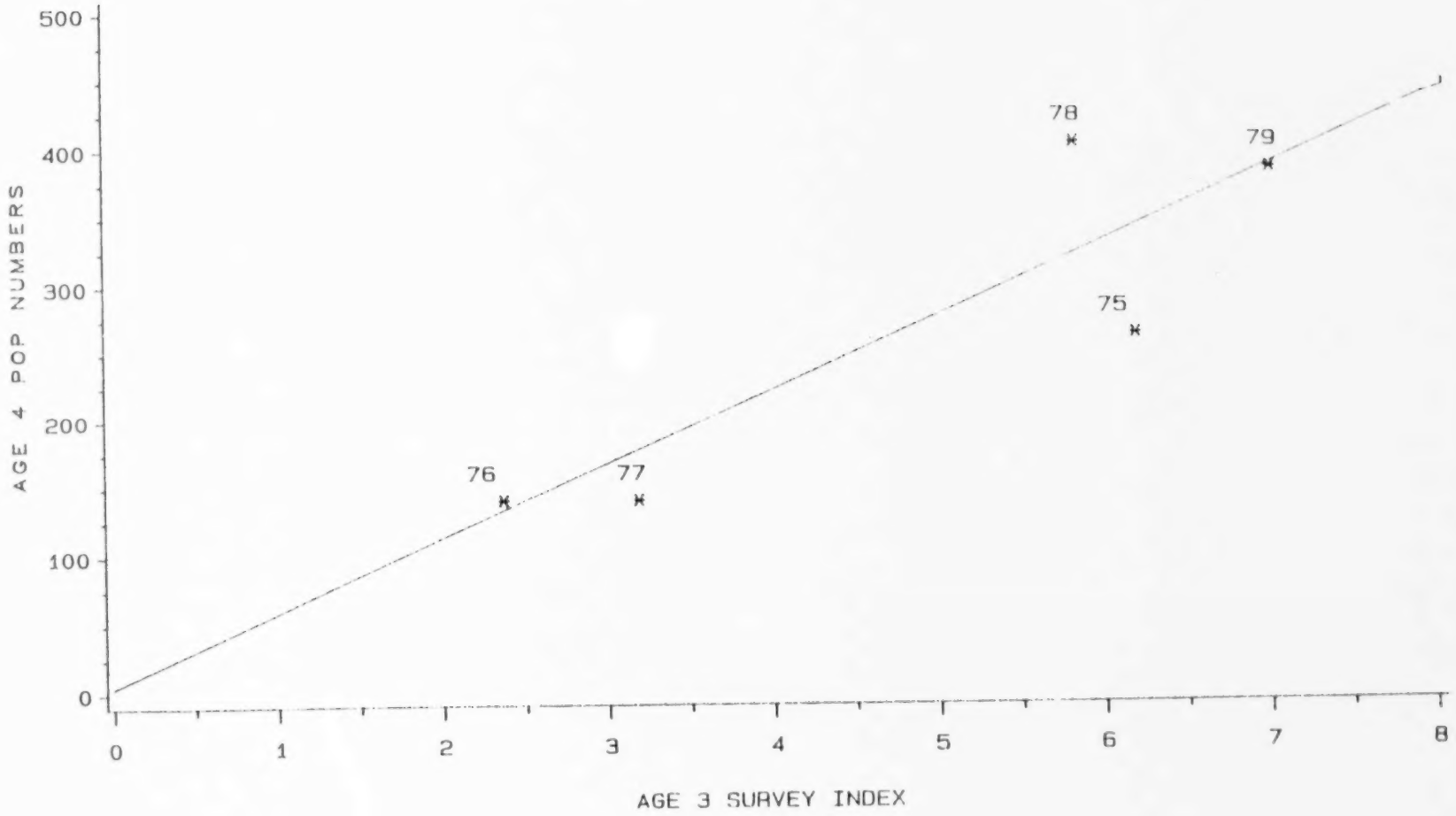

FIG 22. RELATIONSHIP OF AGE 3 SURVEY RECRUITMENT INDEX WITH AGE 4 COHORT ABUNDANCE AT THE BEGINNING OF THE FOLLOWING YEAR FOR THE 1975-79 YEAR-CLASSES.